

Appendix K – Alternatives Development Report

- Alternatives Development Report (Kimley-Horn, 2014)

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Alternatives Development Report

1.0 Introduction

1.1 Purpose of Report

This report has been prepared in support of the US Highway 53 (US 53) Virginia to Eveleth Draft Environmental Impact Statement (Draft EIS). The main objective of this report is to provide a description of the alternatives development, evaluation, and decision-making process that occurred after the 2012 Scoping Decision Document (SDD) was released. This process included developing and refining the alternatives identified in the 2012 SDD as those to be carried forward to the Draft EIS and an initial assessment of impacts and feasibility. This led to an amended Scoping process that reassessed and refined some Scoping alternatives and resulted in an additional alternative to be studied in the Draft EIS (as documented in the 2013 Amended SDD).

In addition, this report summarizes the issues considered in the refinement of alternatives to be evaluated in the Draft EIS and the resulting design features for each of the Draft EIS alternatives. It should be noted that the design assumptions made for this report were based on concept level layouts and standard design practices. These assumptions were not intended to be used to limit future design; rather, the intent was to establish general parameters for evaluation of the extent of potential impacts.

This report includes:

- An overview of the 2012 Scoping process decisions regarding alternatives to be carried forward for study in the Draft EIS
- A description of the 2013 amended Scoping process, including reassessment and refinement of previously scoped alternatives, and resulting decision-making
- Description of design considerations, potential impacts, and related refinement of design details for each of the alternatives being studied in the Draft EIS

1.2 Project Background

Since May 1960, the Minnesota Department of Transportation (MnDOT) has operated a segment of US 53 on an easement agreement granted by United States Steel Corporation (now RGGS Land and Minerals Co.). This roughly one-mile segment of US 53, from approximately 2nd Avenue West to Vermillion Drive in Virginia, is subject to iron ore mining rights held by RGGS and Cliffs Natural Resources – United Taconite Division (the mine’s owner and operator, respectively). Under the 1960 easement terms, MnDOT agreed to relocate US 53 upon notice from the mine owner/operator.

On May 5, 2010, United Taconite (UTAC)¹ provided notice to MnDOT that the 1960 easement rights would be terminated. MnDOT has negotiated with RGGS a May 2017 date as the deadline for vacating the existing easement agreement area.

2.0 2012 Scoping Process

MnDOT released the US 53 Scoping Document in February 2012, which described the process used to assess the range of initial project alternatives considered. During the Scoping period, more than a dozen alternatives were studied for their ability to meet the project Purpose and Need and were compared

¹ United Taconite (UTAC) is a division of Cliffs Natural Resources, Inc. UTAC leases the property from the land and mineral owner, RGGS Land and Minerals Co. For brevity, most references in this document will refer simply to “UTAC.”

against social, economic, and environmental screening criteria (**Exhibit 2.1**). MnDOT's Scoping process resulted in several alternatives being dropped from further consideration based on other alternatives having fewer anticipated impacts. The final Scoping Decision Document (SDD), distributed in September 2012, provided a summary of the Scoping process, including public/agency coordination, the process findings, and the proposed scope and focus of the EIS. The alternatives carried forward to be studied in the EIS included the No Build, Existing US 53, M-1, and E-2 Alternatives (**Exhibit 2.2**). The SDD (September 2012) can be accessed via the project website for further information on the 2012 Scoping alternatives evaluation and decision-making process.²

3.0 2013 Amended Scoping Process

An amended Scoping process was initiated in 2013 due to more detailed information obtained during the refinement and assessment of costs, impacts, and feasibility of the Draft EIS Build Alternatives identified in the 2012 SDD. During the amended Scoping process, some Scoping alternative alignments that had been dismissed from further consideration during the 2012 Scoping process were reconsidered (specifically Alternatives W-1 and E-1). Also, minor alignment modifications to one of the alternatives (Alternative E-2A) were assessed for the potential to improve the feasibility and/or cost-effectiveness of Alternative E-2. As a result of further analysis, one additional alternative has been proposed for detailed study in the Draft EIS: Alternative E-1A (**Exhibit 3.1**). The Amended Scoping Decision Document (ASDD) (September 2013) summarizes the additional alternatives assessment and decision-making process. The ASDD can be accessed via the project website.³

The design refinement and decisions regarding the two Build Alternatives reassessed in the amended Scoping process but not carried forward for study in the Draft EIS are described in Section 3.1 below. The refinement of Alternative E-1A, which was carried forward for study in the Draft EIS as a result of the amended Scoping process, is described in Section 4.4 below.

3.1 Alternatives Not Carried Forward from the Amended Scoping Process

As part of the amended Scoping review process, two 2012 Scoping alternatives were refined and reconsidered for further evaluation (Alternatives E-2A and W-1A). However, even with minor adjustments/modifications to make them more viable than the original alignments, the decision was made not to carry these alternatives forward to the Draft EIS as they had greater potential impacts than other Draft EIS alternatives already being studied. The evaluation of these alternatives is described below. These alternatives are shown in **Exhibit 3.2**.

3.1.1 Alternative E-2A

This alternative followed the same alignment as Alternative E-2 except between MN 135 and the new Landfill Road access where it shifted east around a tailings basin, through the Off Highway Vehicle Recreation Area (OHVRA) managed by the Minnesota Department of Natural Resources (DNR). This shift to the east was made in an attempt to completely avoid any encumbrance of mineral resources. The loop was made large enough to avoid to the extent possible valuable mineral stockpiles and the tailings basin east of Landfill Road that have recoverable minerals.

Design Modifications

A constrained highway cross section (as shown in **Exhibit 3.3**) (12 foot driving lanes, four foot inside shoulder, two foot median barrier, and 10 foot outside shoulder) was assumed to minimize the roadway footprint for most of the alignment except at the intersections at MN 135, Landfill Road, and 2nd

² Available at <http://www.dot.state.mn.us/d1/projects/hwy53relocation/scoping.html>

³ Available at <http://www.dot.state.mn.us/d1/projects/hwy53relocation/scoping.html>

Avenue. A 14 foot trail and utility corridor, via a MnDOT permit, would possibly be provided along the north side of the alignment, which would be constructed as part of the project but funded by others.

Additional Design Considerations and Potential Impacts

In addition to the geometric considerations described above, there were a number of other considerations that shaped this alternative.

As with Alternative E-2, this alternative would completely avoid UTAC's permit to mine boundary (see **Exhibit 3.4**), minimizing the business risk to UTAC regarding air quality permit compliance. However, moving the alignment further to the southeast encroached upon the OHVRA to a greater extent than Alternative E-2, isolating a large portion of the recreation area that would be difficult to mitigate. To address DNR concerns with this alternative, additional drilling was conducted to determine if this shift would provide the benefit intended (avoiding mineral resources west of Landfill Road). The drilling results indicated that the edge of the formation is 200-400 feet west of Landfill Road; therefore, both Alternatives E-2 and E-2A would avoid mineral resources in this area.

With this information, Alternative E-2A was not proposed to be carried forward for further study in the Draft EIS at this time, since it is anticipated to result in greater impacts to the OHVRA while providing no identifiable benefits over Alternative E-2.

Design Details

- This alternative followed the same alignment as Alternative E-2 except between MN 135 and the new Landfill Road access, where it was shifted east around the tailings basin and through the OHVRA

3.1.2 Alternative W-1A

Alternative W-1A was also developed as part of the amended Scoping process in 2013 as a Build Alternative that could avoid impacting mineral resources. This included reassessment of the extent of potential social, economic, and environmental impacts versus the potential benefits of this alternative in avoiding impacts to the Biwabik Iron Formation. This alternative included a four-lane roadway approximately 13.5 miles in length and largely followed existing highways (MN 37 and County Road (Co.) 7).

Design Modifications

A typical section was used for this alignment (**Exhibit 3.3**) (four lanes, 12 foot driving lanes, four foot inside shoulder, and 10 foot outside shoulder).

This alternative included four grade-separated railroad crossings that would each need 23 feet of vertical clearance. It also included a new bridge that would be constructed at the MN 37/US 53 intersection.

Additional Design Considerations and Potential Impacts

In addition to the geometric considerations described above, there were a number of other considerations that shaped this alternative. A key consideration was that this alternative increased the travel distance between the cities of Eveleth, Gilbert, and Virginia, adversely affecting businesses and residents. Travel times for emergency response and school district operations also increased.

This alternative had large impacts to wetlands and water resources, and it had a substantial user cost increase compared to existing conditions.

This alternative was not carried forward for further consideration in the Draft EIS since other Build Alternatives would meet all of the identified project needs with less severe social, economic, and environmental impacts.

Design Details

- Changes to 2012 Scoping Alternative W-1 in the development of 2013 Alternative W-1A included the addition of a direct connection from Co. 7 to US 53. The connection included intersection improvements at 13th Street South, 17th Street South, and Unity Drive. The alternative also included extensive intersection improvements at Co. 7/Co. 101, MN 37/Co. 7, and MN 37/existing US 53. These intersection improvements were added to provide better traffic flow for travelers by making US 53 a continuous through route to address the identified transportation needs.
- Alternative W-1A made its northern connection to US 53 approximately at the 13th Street South traffic signal on the west side of Virginia
- Alternative W-1A made its southern connection to existing US 53 by way of MN 37 south of Eveleth
- This alternative was approximately 13.5 miles in length and largely followed existing highways (MN 37 and Co. 7)
- This alternative required up to four grade-separated crossings (bridges) over existing railroads, which were necessary to provide the safety and capacity required for a four-lane divided highway and forecast traffic volumes
- Noise walls were expected to be required in at least three areas: the Long Lake area on the north side of the alignment, Co. 7 manufactured home area on the east side of the alignment, and on both sides of the north end of the alignment
- Modifications were required at four intersections, including Co. 7/US 53, Co. 101/US 53, the intersection north of the existing MN 37/US 53 intersection, and the north end of new US 53/existing US 53 tie-in

4.0 Description of Draft EIS Alternatives

The following provides a brief description of each alternative and the factors considered in refining the alternatives for assessment in the Draft EIS.

For each of the Build Alternatives there was a baseline set of design concept assumptions that were used to estimate the project footprint and assess the potential worst-case impact area, including:

- Four-lane capacity, divided with 64 foot median spacing (centerline to centerline)
- Typical cross section (12 foot driving lanes, four foot inside shoulders, 10 foot outside shoulders, 1:4 side slopes)

However, some modifications were made for specific alternatives as needed to avoid/minimize environmental impacts and/or excessive costs. The alternatives descriptions that follow include discussion of modifications made, where applicable.

4.1 No Build Alternative (Easement Agreement Area Closed)

The No Build Alternative responds to the existing easement agreement terms by closing the segment of US 53 within the existing easement agreement area, resulting in traffic being rerouted to existing highways. Signage would be used to officially mark the rerouting of US 53, which would follow existing MN 37, Co. 7, and US 169 (between Co. 7 and existing US 53) (see **Exhibit 4.1**). No improvements would be made under the No Build Alternative to these roadways.

Design Concept Modifications

The No Build Alternative is required under NEPA to be used for comparison with the Build Alternatives and typically involves no improvements. With the existing easement agreement area needing to be vacated, this No Build is different than a typical road project as permanent traffic rerouting is necessary. Therefore, signage and re-designation of routes is required. During the 2013 amended Scoping process, there was discussion regarding whether improvements were required or should be made to other roadways and railroad crossings, or if new connections should be made to dead end segments of road due to the closure of the existing easement agreement area segment. However, to maintain a true No Build (minimal action) for comparison purposes, no new road connections or improvements are included in this baseline alternative.

Additional Design Considerations to Address Potential Impacts

Even though this alternative will have substantial impacts to traffic operations, other design considerations were not evaluated or included as part of this alternative. The intent of the No Build Alternative is to provide a baseline for comparison of doing nothing as opposed to the proposed Build Alternatives.

Design Assumptions

- The US 53 existing easement agreement area would be vacated from MN 135 to 2nd Avenue, including removal of the existing pavement and sub-base
- The south interchange of MN 37 and existing US 53 would remain in place, marking the location where northbound traffic would depart from existing US 53 to the newly signed route (existing MN 37)
- The four-mile segment of existing MN 37 to be used as US 53 is a two-lane highway with left and right turn lanes located at the intersection with Co. 7
- Northbound US 53 traffic would make a right turn from MN 37 to Co. 7, a two-lane highway, travelling 8.75 miles before making a right turn at the signalized intersection with US 169. Four existing at-grade railroad crossings in this corridor would remain at-grade.
- Less than a half-mile segment (0.4 miles) of four-lane US 169 would be used to the east to make the connection back to existing US 53 at the US 169 interchange
- MN 135 is currently routed from Gilbert through the existing easement agreement area segment and into Virginia. The designation for MN 135 would be rerouted to the south using the existing US 53 alignment (starting at the existing US 53 northbound ramp to MN 135 and restriping to allow the southbound movement) to the south MN 37 interchange where it would follow the new US 53 route west along MN 37.
- US 53 within Virginia, between the US 169 interchange and the existing easement agreement area terminus near the 2nd Avenue interchange, would be turned back to local government jurisdiction

4.2 Existing US 53 Alternative (Easement Agreement Area Remains Open)

The Existing US 53 Alternative, though not in compliance with the terms of the existing easement agreement, would keep US 53 in place and open to traffic by addressing the economic, legal, and/or engineering issues associated with resolving the terms of the easement agreement. The State of Minnesota would not vacate the segment of US 53 within the existing easement agreement area but would keep the highway open (**Exhibit 4.2**).

Keeping the highway open in its current location would require the State of Minnesota to acquire the property by direct purchase and most likely the use of eminent domain. If the eminent domain action were successful, the cost of the land may equal or exceed the cost of the ore reserves initially estimated

at values of \$400-600 million.⁴ Therefore, as part of the design refinement for this alternative, options were considered that would reduce the amount of right-of-way needed to maintain a roadway through this corridor.

Design Concept Modifications

No modifications to the existing roadway would be made under this alternative.

Additional Design Considerations to Address Potential Impacts

It has been determined that no changes to existing roads would be required for this alternative if the existing easement agreement area and mineral rights are purchased. However, given the high potential cost of acquiring mineral rights, opportunities for reducing the area to be purchased and overall purchase price were investigated. In other words, it was asked: what is the minimum area needed to maintain a road crossing at this location, which is outside the permit to mine boundary? It is known that mining access would be required under the road so as to not prohibit access to the permit to mine boundary (shown in **Exhibit 3.4**) north of the existing easement agreement area. Therefore, if mining access could be provided to mineral resources, would that reduce the acquisition/mineral rights cost for this alternative? It is clear that the existing easement agreement area near MN 135 is very wide. Based on these factors, opportunities for consolidating the road alignment and providing a bridge for mine equipment crossing were investigated.

A consolidated cross section was considered to minimize needed right-of-way that would include bringing the northbound and southbound lanes of existing US 53 together with an assumed constrained cross section using a reduced median and steeper side slopes (12 foot driving lanes, four foot inside shoulder, two foot median barrier, 10 foot outside shoulder). Because the roadway would remain on in situ rock/soil, by converting the roadway to a constrained section it is expected that the right-of-way needed could be much narrower in comparison to what is there today. However, with mining activity and blasting setbacks, the narrowed right-of-way would not allow the mine to access much of the existing easement agreement area without closing the road during mining operations.

A bridge approximately 670 feet long and up to 300 feet tall was considered to allow access to some of the ferrous resources within the existing easement agreement area. Access across the road would be necessary for UTAC to get material excavated on the north side of the road/existing easement agreement area to the crusher and rail line south of the roadway/existing easement agreement area for processing and shipping, respectively. Construction may require temporary closure of the corridor and rerouting traffic to other roadways, similar to the No Build Alternative. The realignment of the northbound and southbound lanes would also require replacing the existing MN 135 interchange with an at-grade intersection.

Additionally, by keeping the existing US 53 easement agreement area segment operational and providing mining access under the roadway, it is expected that routing a public roadway through an active mine area may subject the mine to business/operation impacts by having to meet air quality standards (National Ambient Air Quality Standards (NAAQS) for particulate matter/dust) at the road.

⁴ The valuation range of \$400 to \$600 million is based on the potential royalty value of the existing US 53 easement agreement area segment (the land & mineral values) plus the potential business volume (margin) that could be derived from mining, processing, and shipping the iron ore. This range was calculated based on publicly available data about the mine, with input from UTAC and the Minnesota DNR Land and Minerals Division. This estimate does not account for lost jobs or tax revenue if the mine closes or cannot expand. The range is provided for the purpose of comparing alternatives and does not represent a negotiated value between the State of Minnesota and the mine's owners and operators. A large contingency is reflected in this range because of uncertainty in how the alternative would work both legally and physically. This initial cost estimate may change in the DEIS, as additional information is obtained.

It was concluded that the amount of mineral resources that would be made accessible by these road modifications would be minimal due to mining setbacks and air quality requirements/constraints. Therefore, the intended benefit of this road modification would be minimal, and it was determined not to be carried forward as part of the Existing US 53 Alternative.

Design Assumptions

No modifications to the existing roadway would be made under this alternative.

4.3 Alternative M-1

Alternative M-1 is routed through the active UTAC mine (see **Exhibit 4.3**). The alignment through the mine was initially suggested by the mine operator in a location that was believed to have had most of the ferrous resources removed and backfill generally placed throughout much of the alignment.

The following details for this alternative have been refined since 2012 Scoping based on the considerations outlined below.

Design Concept Modifications

A constrained highway cross section (12 foot driving lanes, four foot inside shoulder, two foot median barrier, and 10 foot outside shoulder) with approximately 1:2 side slopes was assumed through the mine for approximately one mile (4,950 feet) to keep the roadway footprint through the mine as narrow as possible.

The elevation of the road was raised to the extent possible to minimize potential business/operation impacts due to air quality standards within the mine. Minimum design specifications for bridge dimensions and locations were obtained from UTAC .

Additional Design Considerations to Address Potential Impacts

In addition to the geometric considerations, there are a number of other factors that shaped development of this alternative. A key factor in designing the road crossing was the stability of the existing fill material. The depth and compaction of the fill was important in determining whether the crossing could be on fill or if a structural solution would be required. The most feasible pit crossing method was determined after considering two options:

- Constructing an engineered fill section across the pit with two separate structures to accommodate mine operations. The structures would be located near the north and south ends of the pit crossing at locations identified by UTAC.
- Constructing the pit crossing primarily on structure to address potential fill settlement concerns

Borings were conducted by MnDOT to confirm the condition of existing fill.⁵ A seismic study was also conducted to determine the potential effects of blasting on fill slopes and bridge structures within the mine area.⁶ As a result, it was determined that an engineered fill could be used across most of the mine with bridges constructed in two locations to accommodate mining access needs. An all fill section would not allow mine equipment to cross the road, and an all bridge section would be more costly.

The engineered fill could be constructed with approximately 1:2 slopes, minimizing the footprint of the fill section in the mine (average of 375 feet wide at base of fill). It was assumed that the engineered fill may need to extend down to the pit bottom rather than placed on top of the existing uncompacted backfill material. The depth of the active mine south of this alignment currently ranges from 100 to 200 feet deep. Future mining along the west side of the mine may extend down 500 feet or more; to protect

⁵ Preliminary Geotechnical Engineering Report (Gale-Tec Engineering, 2013)

⁶ Proposed TH 53 M-1 (and E-2) Alignment: Report of Seismic Study of Mine Blast Induced Vibrations (HDR, 2013)

the structural integrity of the roadway/structures, the mining setback may need to extend beyond the fill footprint (toe of slope). Therefore, MnDOT may require a setback greater than the 300 feet from toe of slope required by current mining practice, limiting the proximity of blasting and excavation.

By constructing a public roadway through an active permit to mine area and providing mining access under the roadway, it is expected that the road location may result in business/operation impacts to the mine due to air quality standards (NAAQS for particulate matter/dust) at the road.

Based on the above information, UTAC notified MnDOT in February 2013 that they no longer could support this alternative. Their correspondence stated that “Cliffs has determined that we cannot risk the future viability of United Taconite by encumbering ore, creating an environmental compliance risk or accepting health and safety hazards that come with the through-pit alignment (M-1), so UTAC cannot grant an easement for the M-1 corridor.”

Design Assumptions

Even though the current mine operator does not support this alternative, it is being carried forward for further analysis since the opportunities for crossing the ore body are limited and could still be determined a viable alternative. Based on the above considerations this alternative was defined for analysis using the following design assumptions.

- From south to north, this alternative would depart from existing US 53 close to Cuyuna Drive in the Midway area of Virginia. Approximately one mile of new four-lane roadway would be constructed to mostly follow the grade created by the partially-backfilled Auburn Pit through the UTAC mine. As shown on **Exhibit 4.4**, the new alignment would connect back to existing US 53 approximately 1,000 feet east of the existing 12th Avenue traffic signal.
- Earthwork and structures (two bridges) would be incorporated into the alignment design to allow for mine operations on both sides of the new alignment
- Existing highway connections at MN 135 and 2nd Avenue would be reconstructed to maintain community access, reusing portions of the US 53 roadway to the extent possible. The MN 135 connection would require right-of-way acquisition or a new easement with RGGS and UTAC for the retained portion of existing US 53 within the mine setback area.
- The MN 135 connection would be made by routing MN 135 on to a portion of the existing northbound US 53 highway segment south of the current US 53/MN 135 interchange. The new intersection would be at-grade, with the primary turning movement (westbound MN 135 to northbound US 53) facilitated with a free right turn lane. A left turn lane would be provided for the southbound US 53 to eastbound MN 135 turning movement (intersection geometry shown in **Exhibit 4.5**). This intersection would be signalized.
- Due to the proximate location of Cuyuna Drive and the US 53/MN 135 intersection, local street access at Cuyuna Drive would be modified to provide adequate intersection spacing. Instead of providing Cuyuna Drive direct access from US 53, access would be provided from MN 135 to accommodate intersection spacing guidelines. As shown in **Exhibit 4.4**, Cuyuna Drive would be connected to MN 135 by extending Midway Drive north near the new intersection with US 53.
 - An interchange option is not being evaluated for this intersection because at this location near Midway there is not adequate space necessary for an interchange above the mine wall without involving substantial business and residential relocations in Midway.
- The connection to 2nd Avenue would be retained by using a portion of the existing US 53 highway between 2nd and 12th Avenues, which is outside of the existing easement agreement area segment that would be vacated. 2nd Avenue would be extended to create a new at-grade intersection approximately at the present location of Southern Drive in Virginia. This new

intersection would be spaced approximately 1,000 feet east of the 12th Avenue traffic signal. The northbound segment of US 53 to be used for extension of 2nd Avenue currently features four bridge structures: a pair over 6th Avenue and a pair over a now vacated railroad corridor. The northbound bridges would remain in use, whereas the southbound bridges would be removed along with the southbound traffic lanes. Coordination with the local jurisdictions (County and City) would be necessary to make a determination regarding future ownership of these local connection roadways.

- The local street connection of 6th Avenue and Southern Drive, which provides access to the Ridgewood area south of US 53, would be improved under Alternative M-1 by adding direct access to US 53 via the new 2nd Avenue intersection. New street connections in Alternative M-1 would be made by retaining the 6th Avenue underpass of northbound US 53 as shown in **Exhibit 4.4**. Southern Drive would be connected to US 53 at the 2nd Avenue at-grade intersection, with continued connectivity also to the 6th Street underpass. This design would provide new access to US 53 for the Ridgewood neighborhood, while maintaining through traffic to 6th Avenue via the underpass.
- Unique measures to mitigate the potential mine air quality exceedances at the roadway have been investigated to protect roadway users from particulate matter. UTAC has identified the limited actions it can take to minimize dust exposure at this location. MnDOT has offered measures to minimize user time on the roadway (breakdowns, stalls); however, these measures were determined by EPA to not eliminate the NAAQS exceedance potential. Therefore, MnDOT evaluated the potential for constructing a covering over the roadway (creating a tube-like tunnel) that would provide such exposure protection. The analysis⁷ identified a constructible covering (tunnel) and ventilation system that would potentially keep exposure to users under the PM10 limits; however, it would require substantial construction and operational costs.

Additional Design Considerations to Address Potential Impacts

Exhibit 4.6 shows two alternate alignments that were considered if Alternative M-1 were to connect to MN 135 outside the existing easement agreement area with a two-lane, two-way road. These alignments followed general topography (Blue option) or used existing roadway (Magenta option) where possible. These alignments would require the relocation of at least one business, two to three homes, one to four acres of additional wetland impact (medium quality wetland) and nearly 15 acres of new right-of-way required from 10 or more parcel owners. This option was dismissed due to relocation and wetland impacts.

4.4 Alternative E-1A

Alternative E-1A has similar termini as Alternative E-2, but it is routed through the UTAC permit to mine boundary (shown in **Exhibit 3.4**) parallel to and north of the existing US 53 alignment, following a submerged haul road embankment within the Rouchleau Pit preliminarily identified by UTAC during the 2013 amended Scoping process (see **Exhibit 4.7**). This alternative is derived from the original Alternative E-1 and has been refined since 2012 Scoping based on the considerations outlined below.

Alternative E-1 was initially not carried forward because of potential business/operation impacts to the mine due to the uncertainty of compliance with air quality permit requirements (compared to other East Corridor alternatives), expected higher right-of-way costs due to conflicts with the existing UTAC permit to mine area, and assumed construction costs due to crossing the widest portion of the Rouchleau Pit.

⁷ Alternative M-1 Air Quality Mitigation Technical Memorandum (CH2MHill, 2013), and Structural Cost Estimate for Elevated Tunnel for US 53 Alternative M-1 Air Quality Mitigation (Kimley-Horn, 2013)

With additional information gathered for the E-1A Alternative, it was determined that a feasible crossing of the pit may be achievable.

Two design options for crossing the Rouchleau Pit are included in this alternative:

- **RSS Option:** A reinforced soil slope (RSS) causeway/fill section with a potential future mine access bridge located on the east side of the pit (see description in Mine Access section below). The future mine access bridge location was coordinated with UTAC and the DNR. The structure would be located near the south end of the pit, above the existing water line.
- **Bridge Option:** Crossing the pit on structure, eliminating the need for fill within the Rouchleau Pit, allowing the road elevation to be increased and drain to the west side of the pit. This bridge would allow for future mine access to the north but may restrict distance from the bridge that mining/blasting activity may occur.

A third option was briefly considered which included an alternate bridge crossing location where the bridge would be located off (west) of the submerged haul road embankment. However, given the depth of the pit this area, the pier heights would have been over 200 feet tall. Since the first two crossing options were determined to offer more reasonable design issues, this deep water bridge alignment is no longer under consideration.

Design Concept Modifications

RSS Option: A constrained highway cross section (12 foot driving lanes, four foot inside shoulder, two foot median barrier, and 10 foot outside shoulder) with approximately 1:1 engineered fill embankment slopes was assumed through the Rouchleau Pit for approximately one-half mile (2,800 feet) to keep the roadway footprint in the pit as narrow as possible (**Exhibit 3.3**). A 14 foot trail (10 foot bituminous with 2 foot shoulders), funded by others, would be allowed on the north side of the alignment via a MnDOT permit and was assumed in the estimated right-of-way needed for purposes of evaluating worst case impacts.

Bridge Option: This option would place the road on a bridge structure across the pit, eliminating the need for fill within the Rouchleau Pit. A constrained cross section (12 foot driving lanes, four foot inside shoulder, two foot median barrier, and 10 foot outside shoulder) was assumed with median and outside barriers.

Additional Design Considerations to Address Potential Impacts

There were a number of potential environmental impacts and construction-related issues that were considered in development of both the RSS and Bridge Options, including pit water depth, geotechnical (soil stability) information, mine operations, construction methods, dewatering discharge impacts, and water quality impacts.

Pit Water Depth

MnDOT conducted a bathymetric survey of the Rouchleau Pit to inform the location and design of the alignments (see **Exhibit 4.8**). For reference, the 2014 pit water level was at an elevation of 1,305 feet, and the city water intake is at elevation 1,117 feet.

The survey confirmed the location of a submerged haul road embankment within the Rouchleau Pit that lies five to 30 feet below the current water surface and is approximately 500 to 560 feet wide. Areas adjacent to the submerged haul road embankment range from 30 to over 300 feet deep, with high walls (steep drop-offs) of 60 to 80 feet on the northwest and southeast sides of the submerged haul road embankment.

For the RSS Option, the E-1A fill footprint would need to be designed to be less than 500 feet wide at the base to allow adequate distance between the base of fill and the drop-offs into deep water to ensure road fill stability due to the steepness of the embankment slopes and the fact that the base of the road fill will be submerged after construction.

Geotechnical Concerns

A key factor in designing the road crossing was the stability of the existing fill material in the submerged haul road embankment. The depth and compaction of the existing fill was important in considering whether the crossing could be on fill or if a bridge would be required. In order to evaluate crossing options, borings were conducted by MnDOT (IDEA Drilling, LLC, 2013) to confirm the condition of existing fill within the submerged haul road embankment (see **Exhibit 4.9**). This information was reviewed along with other geophysical data by Gale-Tec Engineering, Inc. and summarized in the Preliminary Geotechnical Engineering Report for E-1A Alignment (Gale-Tec Engineering, 2013). A seismic study was also conducted to determine the potential effects of blasting on fill slopes and bridge structures within the mine area.⁸ As a result, it was determined that an engineered fill could be used across the pit at a cost substantially less than a full bridge. However, due to constructability, stormwater, and business (i.e., air quality permit requirements) impact concerns, a bridge crossing option is also being evaluated in the Draft EIS.

For the RSS Option, the elevation of the road across the pit was determined by balancing the need for keeping the road as high as possible to minimize air quality and road grade concerns with the need to keep the footprint under 500 feet wide and to minimize the amount of fill required. The engineered fill would be constructed with approximately 1:1 slopes. The maximum fill height would be approximately 160 feet and range from 40-160 feet. It was determined that a typical fill section (1:3 or 1:4 slopes) and even a steep fill (1:2) would not fit on the submerged haul road embankment (greater than 500 feet at base of fill), and therefore an engineered/reinforced soil slope was assumed and confirmed feasible by an independent review documented in TH 53 RSS for Alternative E-1A Memorandum (Parsons Brinkerhoff, 2013).

For the Bridge Option, the pit is approximately five to 25 feet deep at the crossing location, and the bridge would span approximately 3,000 feet. The alignment would follow the submerged haul road embankment to minimize pier height. This option must consider design criteria to withstand blasting operations in the adjacent mine.

Ferrous Resources

Based on the width of the road fill section with the RSS Option, similar to Alternative M-1, there was concern regarding encumbrance of ferrous resources. The recent geotechnical borings also confirmed that the majority of the ferrous resources have been removed from under the E-1A alignment, except in the location near 2nd Avenue on the west side of the pit. Due to blasting buffer zones and other mining regulatory restrictions, it appears the identified ferrous resources will not affect the proposed roadway location due to the proximity of the ferrous resources to the city of Virginia. Therefore, the resources are not accessible with or without the E-1A Alternative, unless portions of existing development in the city were relocated.

On the east side of the Rouchleau Pit, the DNR had similar concerns regarding encumbrance of resources under both the RSS and Bridge Options. There are ferrous rich stockpiles on the east side of Landfill Road according to the DNR (landowner) (see **Appendix A – Mine Stockpiles**). Therefore, the eastern shift of the alignment took into account avoiding the stockpiles to the extent possible. In

⁸ Report of TH 53 E-1A Alignment Seismic Study (HDR, 2013)

addition, the DNR raised concerns regarding potential non-ferrous metallic resource exploration (primarily for gold) on School Trust land in Section 16 on the east side of the pit. The DNR also expressed the need to minimize impacts to the OHVRA (a Section 4(f) property) east of Landfill Road.

Mine Access

The RSS Option would allow for the potential future construction of a mine access bridge on the east side of the pit (above the water line) to allow future mining access to the permit to mine area east of the new road alignment. The future mine access bridge could be sized to accommodate passage of mining trucks (75 feet high by 165 feet wide) under the roadway. By constructing a public roadway through a permit to mine area, and providing future mining access under the roadway, there were concerns regarding potential business impacts to the mine if the proximity and configuration of the road would result in potential for mine air quality compliance issues at the road. Therefore, MnDOT has been coordinating with UTAC on the design considerations for this alignment to minimize such concerns.

The Bridge Option would require a separate mine access bridge because the bridge spanning the Rouchleau Pit would provide mine access to the northeast of the E-1A Alternative. UTAC informed MnDOT that it did not have air quality compliance concerns for this option based on road location and elevation with respect to planned stockpile areas and mine traffic.

Construction Methods

For the RSS Option, road construction across the pit could occur in either wet conditions (fill placed below water level) or dry conditions (temporarily remove water from construction limits).

There were two key considerations regarding dry construction:

- **Water Quality**

There are measures that have been considered to minimize potential water quality impacts during and post-construction.

- Post-construction: These measures include slope stabilization, storm water collection/treatment, and a spill containment system, all of which would be incorporated into the design.
- During construction: With construction in the dry condition, there would be limited exposure to the water body from construction materials. By using standard best management practices (BMPs) for erosion control for water crossing conditions and specific BMPs for slope stabilization during construction, potential impacts from turbidity, sedimentation, and road runoff would be eliminated or minimized to the extent possible. Additionally, by specifying that clean fill material (meaning material that is free from contaminants) be used, the potential to release contaminants into the water body would be avoided.

- **Dewatering**

Localized dewatering (coffer dam) or a drawdown of the Rouchleau Pit would be required for dry road construction. The water volume necessary to draw the pit down 30 feet is substantial (2.65 billion gallons), especially if dewatering needs to occur over a short period of time (estimated at three months for initial draw down), which may impact other surface waters (i.e., the receiving waters) as well as other pumping/appropriation activities (e.g., mining and city water supply). On the other hand, localized dewatering may have issues related to constructing a feasible means of isolating the construction area from the adjacent water column.

- Pit Drawdown Method: Potential methods for dewatering were investigated in the TH 53 Relocation Alternative E-1A RSS Construction Option Water Management Study (HDR, 2014) which are summarized in Table 5.2 (attached in **Appendix B**). Alternative E-

1A would cross the pit on a fill section and could require a temporary drawdown of current water levels in the entire pit by up to 30 feet during the construction period. The new road fill would separate the western portion of the pit from the larger water body to the east, but they would remain connected hydraulically. Therefore, water levels west of the new road are expected to slowly rebound and equalize after construction is completed.

If a drawdown of the Rouchleau Pit were implemented, the discharge receiving waters could be impacted by the initial volume of water generated by a three-month drawdown period (estimated at 2.65 billion gallons). Maintenance pumping to hold the water level at 1,275 feet after the initial drawdown is estimated to be 8.2 million gallon per day (approximately 4,400 to 5,700 gallons per minute).

The receiving water options were analyzed in the Water Management Study for their capacity to receive the water volume and the potential water appropriations and water quality permit requirements. Many of the options for a water transfer were eliminated due to the high flow rate associated with the relatively short three month period allocated for the initial drawdown dewatering, which is dictated by the construction schedule. In addition, options were eliminated if the proposed water transfer would impact an existing National Pollutant Discharge Elimination System (NPDES) permit and require either a major modification or permit re-issuance due to schedule constraints related to the timeframe necessary to obtain the required permits.

Feasible options were those that would be considered water transfers between waters of the state (as defined by federal law) and would not be subject to Minnesota Pollution Control Agency (MPCA) water quality permitting, provided that there is no intervening commercial or industrial use of the water and no pollutants are introduced during construction operations or transfer of the water. Any construction activities within the Rouchleau Pit would require coverage under the MPCA's construction stormwater permitting program. Conditions of the construction stormwater permit would preclude the introduction of construction-related pollutants to the water being transferred.

Based on this evaluation, two feasible options were identified for receiving high-volume flows from the initial drawdown dewatering period and one option for the construction maintenance dewatering period. For all three of the options, potential routes were identified that would have the least potential for environmental impacts (see **Exhibit 4.10**). The temporary, above-ground (except at road or railroad crossings) dewatering conveyance piping would be routed primarily within previously disturbed areas (road, railroad, utility corridors, and previously mined/graded areas).

- Coffer Dam Construction Method: Because the submerged haul road sets on 30 to 120 feet of mine waste rock over Upper Cherty bedrock, traditional sheet pile coffer dam construction is not feasible due to the depth of waste rock fill and ability to obtain sheet wall stability to retain 30 feet of water for a length of 2,800 feet. Therefore, alternative methods are being evaluated, including a geotextile tube system.⁹ These methods would be studied in greater detail if the Alternative E-1A RSS Option is selected as the preferred alternative. Initial dewatering of the construction zone should be free of sediment and, therefore, should be able to be pumped directly into the Rouchleau Pit.

⁹ A geotextile tube system consists of a series of stacked large diameter (up to 9 feet) tubes being installed underwater and pumped full of sand to create two parallel temporary walls that would allow the construction zone to be dewatered.

Maintenance dewatering during construction would be pumped to a sedimentation basin before discharging to other surface waters.

There were also two key considerations for wet construction, including water quality and fill stability (achieving necessary compaction).

- **Water Quality**

As noted above for the dry condition, standard construction erosion control measures would be assumed during and post-construction. To construct in the wet condition, however, additional measures to limit potential for turbidity in the Rouchleau Pit would be expected. BMPs such as installation of floating silt curtain, material specification, and other measures would be important to minimize potential for turbidity during construction. Up to three natural submerged land bridges at elevations 60 feet above the city's water intake elevation, between the alternatives and the city's water intake site, limit the potential turbidity that would reach the intake.

- **Fill Stability**

Construction of the lower portion of the new road embankment in the wet would be feasible but more complex and expensive than constructing in the dry. It is anticipated that the underwater fill placement would extend from the top of the existing submerged haul road to the current water level (approximately 30 feet). A method for such underwater fill placement is using rock retention dikes. Zoned fill behind the rock dikes and ground improvement of the retained fill have been used in marine environments to construct fill and appear to be feasible for this project. The road embankment above the current water level would be constructed in the dry. Additional measures would be needed for the existing fill in the submerged haul road embankment and the fill placed in the underwater condition to reduce future settlement potential and increase shear strength of the fill to support the engineered fill embankment of the new roadway. A number of specialized compaction techniques have been identified for potential use in constructing this alternative.

Local Road Connections

Locations for the local road connections were evaluated for both the RSS and Bridge Options. The design concept for this alternative in the Draft EIS assumes that the 2nd Avenue interchange would be replaced with a full access, at-grade, signalized intersection, similar to Alternative E-2. This improves access (currently no southbound to westbound movement available) while eliminating the right-of-way and maintenance needed for the existing interchange loop and bridges (see **Exhibit 4.11**).

There is approximately a 100 foot elevation difference between existing Landfill Road and US 53 at the point where US 53 turns west from the Landfill Road alignment. Placing an intersection at this location on a horizontal curve with an assumed four percent downgrade on US 53 and an even steeper grade on Landfill Road is not a sound option for safety. Reconstructing Landfill Road for a longer distance does not result in enough grade reduction to make this location work for Landfill Road truck access and could require greater impact to the OHVRA area, even with consideration of retaining walls. Therefore, rather than creating a new intersection with Landfill Road, the existing Landfill Road intersection would remain with MN 135 at its current location. However, a segment of Landfill Road would need to be shifted east due to elevation difference between the new US 53 alignment and the Landfill Road alignment. The Landfill Road shift would impact the OHVRA, a Section 4(f) property, while minimizing impacts to the potential non-ferrous metallic mineral resources west of Landfill Road and US 53 as requested by the DNR.

Multiple options were also considered for connecting US 53 to MN 135. Due to the elevation differences and the OHVRA boundary, there was one option that stood out: keeping MN 135 on its existing alignment with a slight shift north for the intersection (**Exhibit 4.12**). Shifts of several hundred feet to the south and to the north were considered, but both resulted in substantial new right-of-way, elevation changes, and impacts to wetlands, stockpiles, and other resources. Traffic volumes and movements at this intersection do not warrant a traffic signal. Westbound MN 135 to southbound US 53 would not be accommodated at the intersection due to potential safety concerns, the availability of alternate routes, and low turning volumes in the peak hours (25 to 35 vehicles). This option will be referenced as the Intersection Option.

A compressed diamond interchange was also evaluated for the MN 135/US 53 intersection, as shown in **Exhibit 4.13**. Other interchange configurations were considered but did not provide full access or did not fit within the confined space between the mineable land and the OHVRA. An interchange would also provide full access and maximize traffic safety by eliminating turning movements to/from a four-lane highway. This option will be referenced as the Interchange Option.

Alternate alignments were considered for Alternative E-1A to connect to MN 135 outside the existing easement agreement area with a four-lane road, avoiding or minimizing the relocation and wetland impacts identified in other options described for Alternatives M-1 and E-2. This US 53 alignment shift was incorporated into Alternative E-1A, swinging east from Midway around most of the large wetland before crossing MN 135.

Design Assumptions

Based on the above considerations this alternative was defined for analysis in the Draft EIS with the following assumptions.

- From south to north, this alternative diverges from existing US 53 just north of Cuyuna Drive. The alignment crosses MN 135 between the existing US 53/MN 135 interchange and Bourgin Road. The new alignment then continues parallel to Bourgin Road before turning to the northwest to cross the Rouchleau Pit along an existing submerged haul road embankment on a fill section or a bridge. After crossing the pit, the alignment turns to the southwest to reconnect with existing US 53 near 2nd Avenue.
- Alternative E-1A allows for a shallow crossing of the Rouchleau Pit along an existing submerged haul road embankment. The pit water elevation may be partially dewatered (up to a 30 foot drawdown) to expose the submerged haul road embankment, or localized dewatering (e.g., coffer dam) may be utilized. The road would be constructed either via a fill section or a bridge through the pit.
- The RSS Option allows for future construction of a mine access bridge to allow for mine vehicle passage under US 53 above the water line. This bridge could be needed to access ferrous resources to the north of the road. The time frame for the future mine access bridge, if needed, is estimated at 30 years.
- At US 53 and MN 135 there are two design options: an Intersection Option with a three-quarter intersection (no left turns allowed from westbound MN 135 to US 53) and an Interchange Option with a compressed diamond interchange (see **Exhibit 4.13**)
- A barrier would be considered in the median and on both sides of roadway for safety and screening
- All stormwater will be treated and/or removed from the roadway and not discharged directly into the Rouchleau Pit. The stormwater system would include spill containment.

- MnDOT would install automatic gates and signage to assist with road closures during mine blasting operations
- Any trail (pedestrian, bicycle, ATV, snowmobile) access to the south side of the highway (i.e., the operating mine side) would be prohibited
- The Mesabi Trail could be allowed via a MnDOT permit on the north side of the highway, away from the mine activity (constructed as part of the project, but would be funded by others)
- The Landfill Road intersection with MN 135 would remain at its current location. A short segment of Landfill Road would need to be shifted east due to elevation differences between it and the new US 53 alignment.

4.5 Alternative E-2

Alternative E-2 is routed around the current permit to mine area (shown in **Exhibit 3.4**). The alignment crosses the Rouchleau Pit in a narrow area in the middle of the pit (see **Exhibit 4.14**), with pit walls 130 to 170 feet above the water level. The following details for this alternative have been refined since 2012 Scoping based on considerations outlined below.

Design Concept Modifications

A constrained highway cross section (**Exhibit 3.3**) (12 foot driving lanes, four foot inside shoulder, two foot median barrier, and 10 foot outside shoulder) was assumed to minimize the roadway footprint for most of the alignment except at the intersections at MN 135, Landfill Road, and 2nd Avenue. The narrower cross section was assumed to minimize right-of-way required within Section 4(f) land and within land containing identified mineral resources, including the Rouchleau Pit crossing. A 14 foot trail (10 foot bituminous with two foot shoulders) corridor, funded by others, would be allowed on the north side of the alignment via a MnDOT permit.

Additional Design Considerations and Potential Impacts

There are a number of considerations that shaped development of this alternative concept.

A key consideration is the pit crossing method. The most feasible pit crossing method for this alternative was determined to be a bridge. A fill section across the pit is not expected to be feasible due to the depth of the water and pit walls and the width of the fill footprint. At 1:2 slopes the fill footprint at the bottom of the fill would be at least 950 feet wide and require nearly 10 million cubic yards of fill material; with more standard slopes of 1:4, the footprint and fill material needed would double. Additionally, given the depth of water to be contained on the north side of the fill (125 feet currently), the fill would require engineering for a dam to support the water pressure and withstand blasting vibration. The dam design would need to consider future water level increases as dewatering changes occur. Given the extent of footprint concerns, the dam design requirements, and costs compared to a bridge, the fill option was dropped from further consideration. Therefore, the Alternative E-2 concept assessed in the Draft EIS assumes that the crossing at the Rouchleau Pit would be a structure (bridge) over the pit. The pit would be approximately 250 feet deep at the crossing location, and the bridge would span approximately 1,350 feet. This option must consider design criteria to withstand blasting operations in the adjacent mine. Initial feasibility assessments indicate that a bridge crossing of the pit represents a reasonable alternative with respect to constructability and cost impacts.

Another key consideration in the development of Alternative E-2 is minimizing or avoiding encroachment onto lands owned or leased by RGGS. To accomplish this, one of the Alternative E-2 alignment variations was designed so that the proposed roadway would avoid any current or future conflict with UTAC's lease boundary.

There is also possible conflict with the exploration and mining of non-ferrous metallic resources, such as gold, on School Trust land on the east side of the pit. Ferrous and non-ferrous exploratory boring locations are shown on **Exhibit 4.9**.

The alignment was designed to minimize impacts to the flood control ditches along the west side of Landfill Road to the extent possible, while also avoiding the mineral rich stockpiles and potential mineral deposits east of Landfill Road. Additionally, the alignment along Landfill Road was designed to minimize the impacts to the OHVRA (a Section 4(f) property) east of Landfill Road to the extent possible. Initially, it was not known where the edge of the ferrous resources was located. To identify the edge of these resources in relation to this alternative, additional study was conducted to determine if ferrous resources are present within the Alternative E-2 construction area near Landfill Road. The drilling results indicated that the edge of the formation is 200-400 feet west of Landfill Road; therefore, Alternative E-2 would avoid ferrous resources in this area.

The local street connections for Alternative E-2 are similar to Alternative E-1A, except at Landfill Road, as described in the following design detail section and shown in **Exhibit 4.15**.

Exhibit 4.6 also shows an option that was considered for Alternative E-2 which would provide right-of-way outside the existing easement agreement area for a four-lane roadway for US 53 and an intersection for MN 135 near its current location. This alignment would have a large impact on the Midway area frontage on US 53, requiring relocation of at least six businesses and seven homes. More residential or business relocations and over six acres of additional wetland impact (medium quality wetland) could be required to maintain an access road to the remaining residents and businesses and to provide a noise wall and/or retaining walls along the edge of new right-of-way. This option was dismissed due to relocation and wetland impacts.

Design Details

Based on the above considerations, this alternative was defined for analysis using the following design assumptions.

- From south to north, Alternative E-2 follows existing US 53 from the Midway area and follows the MN 135 exit ramp for the start of new four-lane construction. As shown in **Exhibit 4.14**, the new alignment then continues on a northeasterly track on the present day Landfill Road corridor before turning to the west to cross over the Rouchleau Pit adjacent to an old railroad corridor. Upon crossing the pit, Alternative E-2 turns to the southwest following an abandoned railroad corridor that runs between the pit and residential neighborhoods before reconnecting to existing US 53 at 2nd Avenue.
- With the Intersection Option MN 135 would be slightly realigned to accommodate a new at-grade three-quarter intersection (unsignalized) with US 53, replacing the existing interchange and prohibiting left turns from westbound MN 135 to southbound US 53. A compressed diamond interchange at this location was evaluated (Interchange Option) to compare potential impacts (see **Exhibit 4.16**).
- The 2nd Avenue access would also be converted from the existing partial interchange to an at-grade intersection. The existing 2nd Avenue interchange does not allow for turns from southbound US 53 to 2nd Avenue or from 2nd Avenue to northbound US 53. The new 2nd Avenue signalized intersection would provide access to and from US 53 in all directions (see **Exhibit 4.11**).
- Access to Landfill Road would be maintained with a new at-grade connection approximately one-half mile north of the new US 53/MN 135 intersection. A median break would allow for access to Landfill Road for travelers from both directions on US 53. The US 53 median at Landfill

Road would provide a refuge for large vehicles making turning movements across US 53 at Landfill Road.

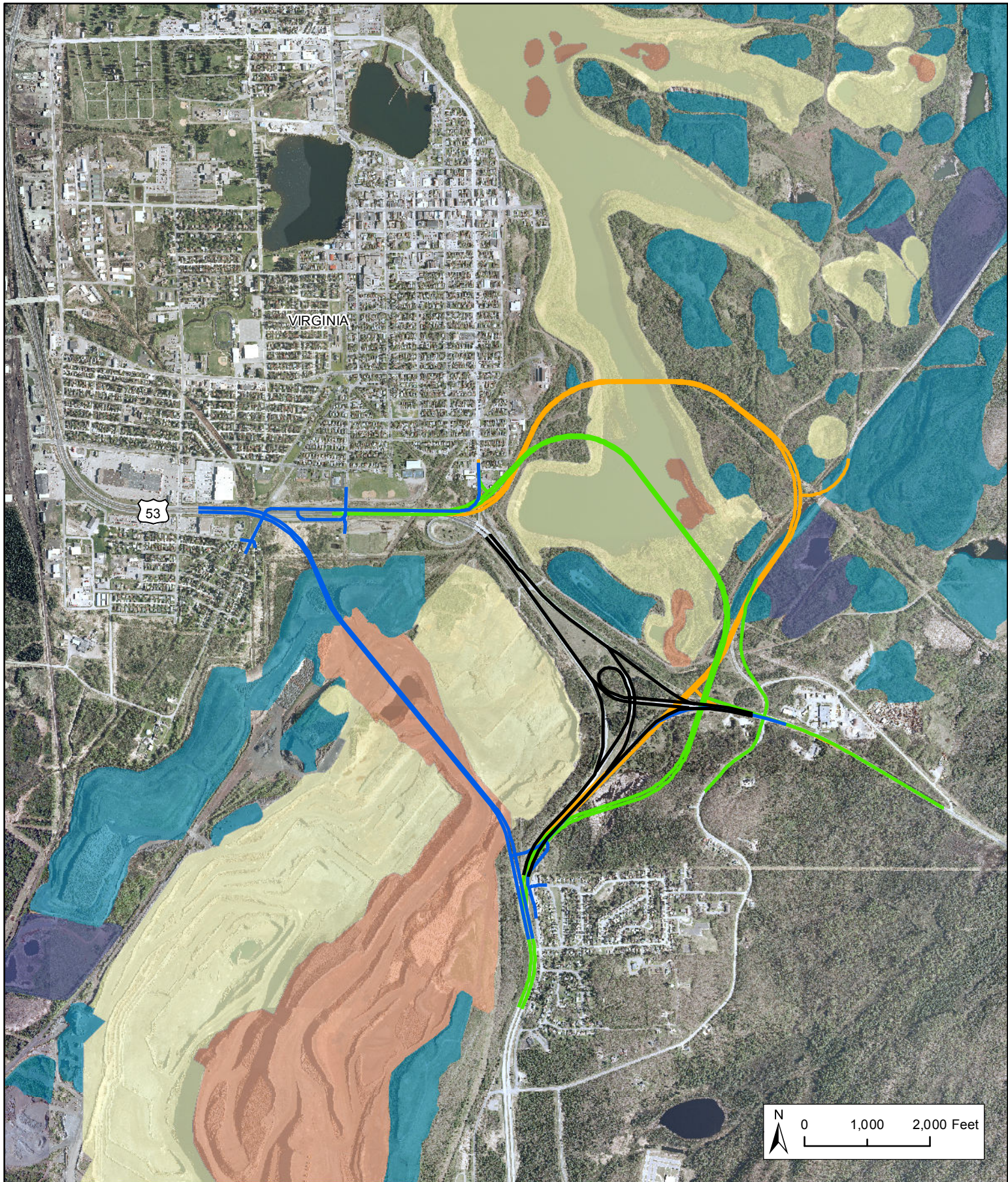
4.6 Areas of Evaluation

The areas shown in **Exhibits 4.3, 4.7, and 4.14** illustrate the area evaluated for potential physical impacts for each alternative. These “areas of evaluation” were defined based on the general design assumptions outlined herein, estimated construction limits, potential additional right-of-way needed for stormwater management and other related transportation functions, and other design factors. The Alternative M-1 area of evaluation represents the assumed alignment for that alternative. The area of evaluation was widened for Alternatives E-1A and E-2 in areas where there is potential for design adjustments in the alignment to accommodate currently undefined solutions to known engineering challenges (e.g., existing areas of unstable fill and bridge type). The intent of evaluating the wider area for Alternatives E-1A and E-2 is to identify potential impacts and determine if there are any environmental resources that could limit implementation of the design options being considered. Since most of the widened area is within the previously mined area in and adjacent to the Rouchleau Pit, the alignment adjustments should result in little difference in impacts to resources except for ferrous resources and right-of-way. To calculate potential impacts for the Draft EIS without overestimating them due to the widened area of evaluation, a corridor averaging 200-400 feet wide was assumed for Alternative E-1A, and a corridor averaging 150-300 feet wide was assumed for Alternative E-2 (the Alternative E-1A RSS Option requires a larger footprint).

Appendix A

Mine Stockpiles

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Sources: USGS Aerial 2011, DNR

Legend

- | | |
|----------------------------|-------------------|
| Existing US 53 Alternative | Pits |
| Alternative M-1 | In-Pit Stockpiles |
| Alternative E-1A | Stockpiles |
| Alternative E-2 | Tailings Basins |



Appendix A
Mine Stockpiles
*US Highway 53 Virginia to Eveleth
 Alternatives Development Report*

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Appendix B

Table 5.2 Potential Dewatering Transfer Locations from TH 53 Relocation Alternative E-1A RSS Construction Option Water Management Study (HDR, 2014)

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Table 5.2
Potential Dewatering Transfer Locations

Location	Description	Evaluation
Sauntry Creek system including Bailey and Silver Lakes	Sauntry Creek system supplemented with diversion from Rouchleau Pit via Enterprise Pit. Flows through channelized creek to Bailey and Silver Lakes in City of Virginia. Silver Lake outlet to East Two River to Mashkenode Lake.	Does not have capacity to receive initial drawdown volume or rate. Initial evaluation indicates system has capacity to receive 4,000 – 6,000 gpm maintenance dewatering. Water transfer would not be subject to water quality permitting. Recommendation: Option for maintenance dewatering transfer.
Enterprise Pit	Inundated pit approx. 0.25 miles north of Rouchleau Pit. Receives discharge from ArcelorMittal pump station in Rouchleau Pit. Intake provides water for ArcelorMittal Minorca Mine water supply system.	Capacity to receive initial dewatering unknown. Level fluctuations associated with large volume input could affect ArcelorMittal pumping operations. Has capacity to receive maintenance dewatering with option to divert to Sauntry Creek system. Purported hydraulic connection to Rouchleau Pit. Water transfer would not be subject to water quality permitting. Recommendation: Option for maintenance dewatering transfer.
Manganika Creek	Largely channelized system through south and east portions of City of Virginia. Receives Virginia stormwater discharge, Virginia POTW discharge, and UTAC dewatering discharge from Thunderbird North Pit.	Capacity to receive initial drawdown volume and rate is limited. Further study required to determine actual capacity and suitability to receive maintenance dewatering. Significant water quality concerns for downstream system associated with flushing Manganika system with increased flow. Recommendation: Not carried forward as option for water transfer.
Manganika Lake	158-acre lake approx. 2 miles southwest of Rouchleau Pit. Receives flow from Manganika Creek and UTAC dewatering operations. Discharges to East Two River via Manganika Creek.	Capacity to receive initial dewatering volume and rate is limited. Significant water quality concerns for downstream system associated with flushing Manganika system with increased flow. Recommendation: Not carried forward as option for water transfer.

Location	Description	Evaluation
East Two River	Inflow from Mashkenode Lake and Manganika Lake. Confluence with St. Louis River approximately 11 miles south of Mashkenode Lake (i.e., 14 miles south of Rouchleau Pit).	Capacity to receive initial drawdown volume and rate is limited. East Two River system requires further study to determine capacity to handle maintenance dewatering. Recommendation: Not carried forward as option for water transfer.
West Two River Reservoir	713-acre reservoir approx. 6 miles west of Rouchleau Pit. Inflow from Parkville Creek. Outlet to West Two River. West Two River's confluence with St. Louis River approx. 11 miles south of outlet. Serves as back-up water source for Minntac operations. Receives Minntac dewatering discharges.	Initial assessment shows reservoir has capacity to receive rate and volume from initial drawdown. Total inflow volume would result in increased outflow from reservoir to West Two River. Initial assessment of West Two River system shows capacity to accommodate increased flow during the drawdown period. Would be considered a water transfer and would not require water quality permitting. Recommendation: Option for initial drawdown transfer.
Pike River	Approx. 2.5 miles east of Rouchleau Pit. Flows north in Hudson Bay watershed.	Transfer of water from Rouchleau would constitute inter-basin transfer and would require agreement through Great Lakes Compact. Project schedule precludes requirements for compact negotiations. Recommendation: Not carried forward as option for water transfer.
UTAC Hull/Spruce Hill Pit complex	Inundated pits approx. 3.5 miles south of Rouchleau Pit.	Combined capacity of Hull and Spruce Hill pits thought to be adequate for initial discharge. Purported hydraulic connection with active UTAC Thunderbird North Pit to the north. Transfer of water from Rouchleau Pit could affect existing mining operations Recommendation: Not carried forward as option for water transfer.

Location	Description	Evaluation
UTAC South Pit	Inundated pit approx. 4 miles south of Rouchleau Pit south of Eveleth. Receives UTAC dewatering discharge. Discharges periodically to St. Louis River via Long Lake Creek to supplement flow for UTAC appropriation.	Based on initial assessment has capacity to receive initial discharge. Transfer of water into South Pit from Rouchleau Pit would affect UTAC NPDES permit for discharge to the St. Louis River. Any change in the make-up of the water ultimately discharged to the River would trigger major permit modification/permit re-issuance. Recommendation: Not carried forward as option for water transfer.
Ore-Be-Gone Lake	Inundated former mine pits near the City of Gilbert	Insufficient capacity to take volume from initial discharge. Purported to have hydraulic connection to Laurentian mine. Increase in volume may affect water level in Laurentian mine and may impact recreational features of lake. Recommendation: Not carried forward as option for water transfer.
Ely Lake	830 acre lake located approximately 2.5 miles southwest of Eveleth. Controlled outlet and connection to St. Mary's Lake.	Lake is highly developed. Transfer of large volume may affect lake property owners. Outlet may not have capacity to handle increased outflow. Recommendation: Not carried forward as option for water transfer.
Minntac Mountain Iron Pit	Inundated pit approx. 4 miles west of Rouchleau Pit in Mountain Iron. Likely has capacity to receive initial discharge Receives dewatering discharge from Minntac mine operations. Used as supply water for Minntac.	Water is considered part of Minntac facility. Transfer of water into Mountain Iron pit from Rouchleau Pit would affect Minntac NPDES permit. Would trigger major permit modification/permit re-issuance. Recommendation: Not carried forward as option for water transfer.
Minntac Tailings Basin Cell 2	Tailings basins approx. 6 miles northwest of Rouchleau Pit.	Has capacity to receive initial dewatering rate and volume. Would require permit action under existing Minntac NPDES permit. Interbasin transfer by Minntac allowed under Minnesota's baseline diversion. Recommendation: Option for initial drawdown transfer.

Location	Description	Evaluation
St. Louis River	Closest point approx. 10.5 miles south of Rouchleau Pit. Ultimately drains to Lake Superior.	<p>Closest discharge point 10.5 miles south of Rouchleau Pit along TH 53. Preliminary DNR assessment indicates that the river has capacity to receive rate and volume from initial drawdown and maintenance dewatering. Would be considered water transfer and would not require water quality permitting.</p> <p>Recommendation: Not carried forward as option for water transfer.</p>

As noted previously, the options for discharge of the Rouchleau Pit dewatering operations were analyzed for their capacity to receive the initial drawdown and/or maintenance dewatering water volume and rates, and the potential water appropriations and water quality permit requirements and implications.

Evaluation Results: Initial Drawdown Receiving Waters

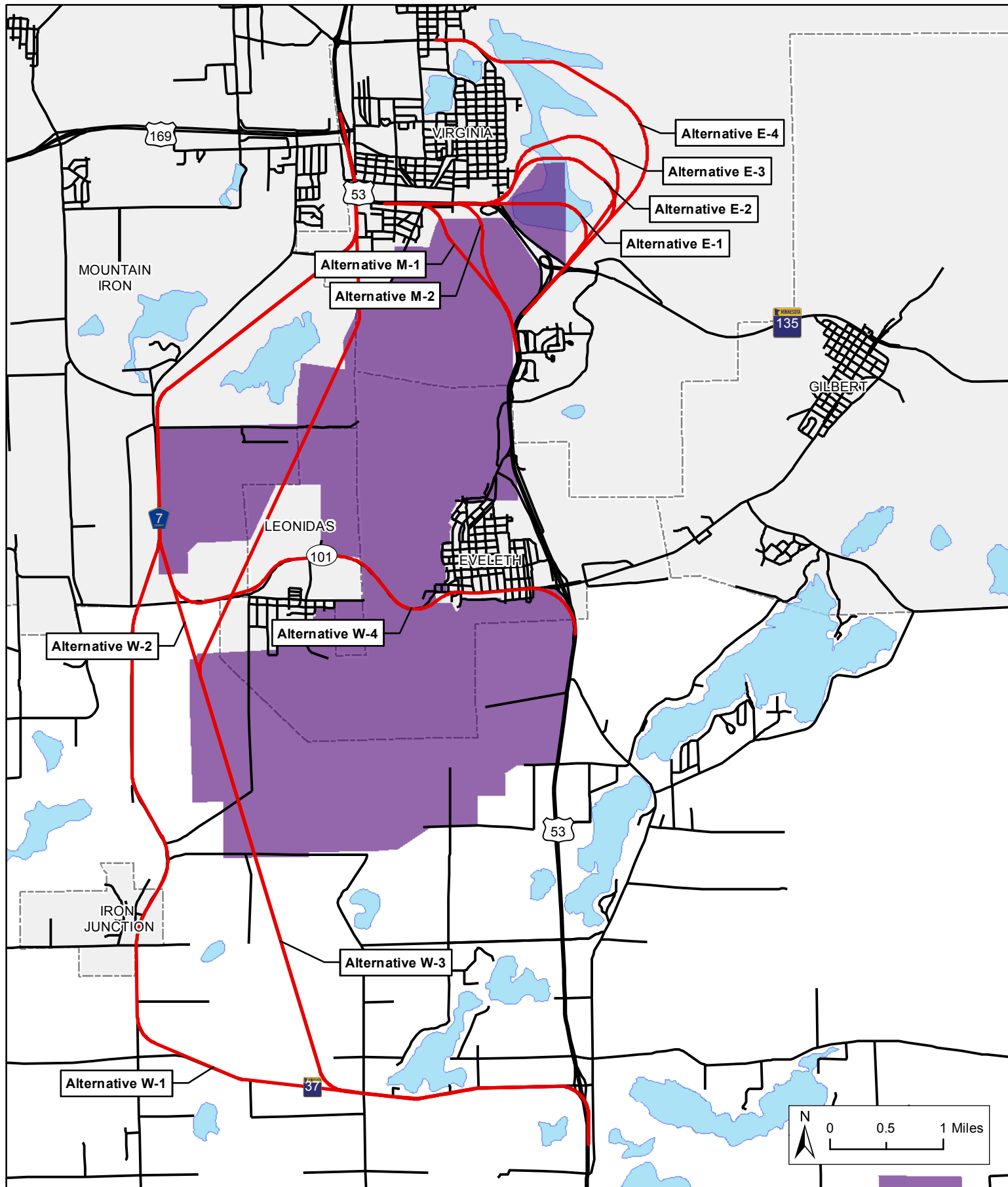
Many of the options for the transfer of the initial drawdown water were eliminated due to their inability to accommodate either the total volume or the high flow rate associated with the 3-month period allocated for the initial dewatering. These include the Sauntry Creek system, Manganika Creek, Manganika Lake, Mashkenode Lake, East Two River and Ore-Be-Gone Lake. The UTAC Hull/Spruce Hill Pit complex and the Enterprise Pit were removed from consideration as options for the initial drawdown volume because of the potential for interference with mining operations. Two other options were removed from consideration because the proposed water transfer and introduction of a new water source could trigger major modification or re-issuance of an existing National Pollutant Discharge Elimination System (NPDES) permit. These included the Minntac Mountain Iron Pit, and the UTAC South Pit. The Pike River was eliminated for either discharge because it would require negotiation of an inter-basin transfer agreement under the Great Lakes-St. Lawrence River Basin Water Resources Compact (Great Lakes Compact) for a new water use, which would not fit within the project schedule. Ely Lake was removed from consideration due to uncertainty of the ability of the outlet to handle the increased volume and outflows, and the risk of water level rise on a highly developed shoreline. The St. Louis River is not recommended at this time because there are other potentially viable alternatives closer to the Rouchleau Pit (described below) that appear to be feasible.

The options that are recommended for further consideration for the initial dewatering period are the West Two River Reservoir and the Minntac Tailings Basin Cell 2.

The West Two River Reservoir is located approximately 5.5 miles west of Rouchleau Pit. It was created in 1963 by US Steel to be used as a water source for mining operations and processing. The reservoir has natural inlets and receives discharges from Minntac dewatering operations. There are two outlets from the reservoir to West Two River, including a fixed-head dam and a siphon-controlled outlet. The siphon, which was included as part of the permit that allowed establishment of the reservoir, provides a minimum flow of 3 cubic feet per second to West Two River to maintain a minimum base flow below the reservoir. West Two River eventually

Figures

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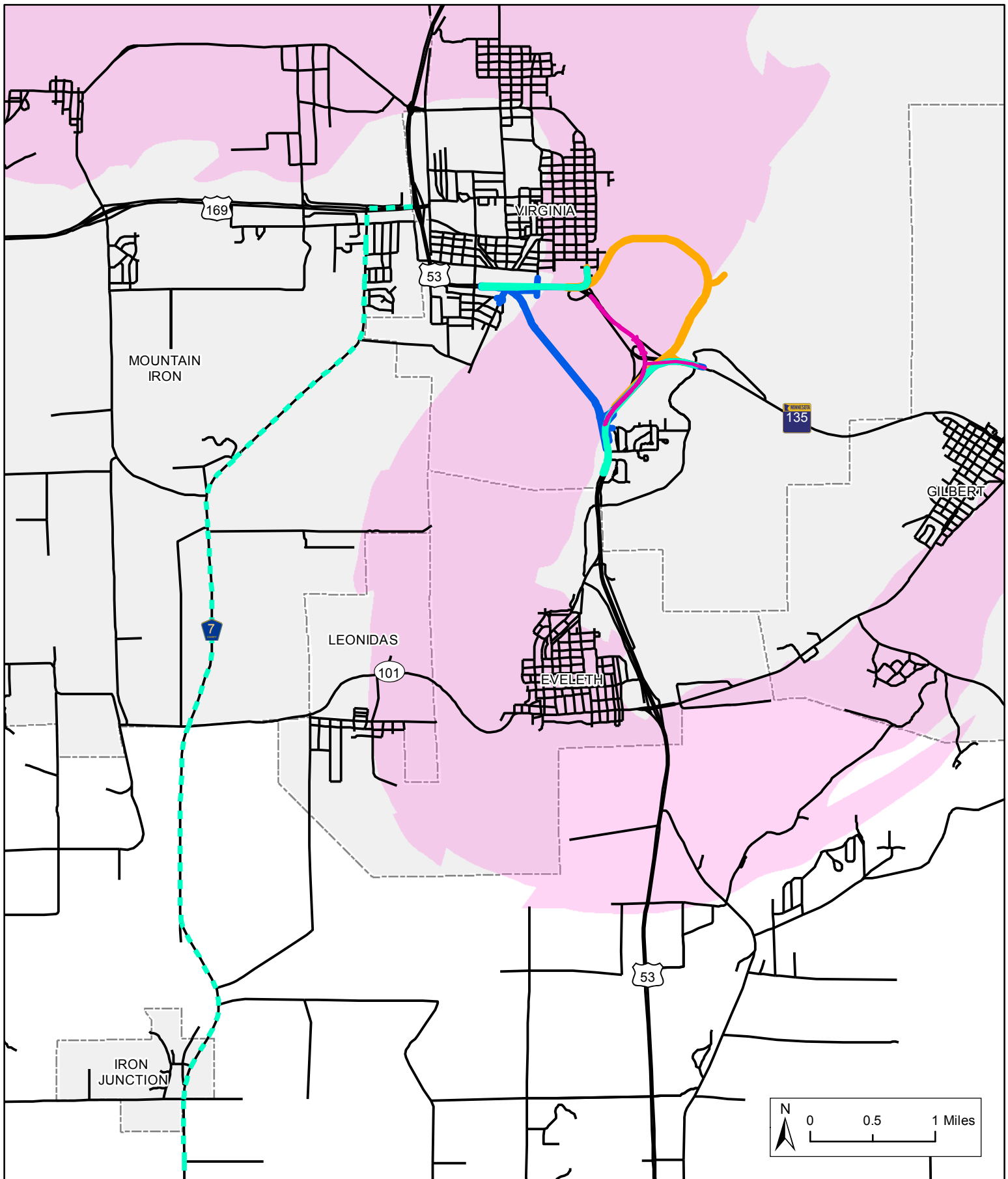


Legend

- 2012 Scoping Document Alternatives
- UTAC Environmental Setting Boundary
- Municipalities

Exhibit 2.1
2012 Scoping Document Alternatives
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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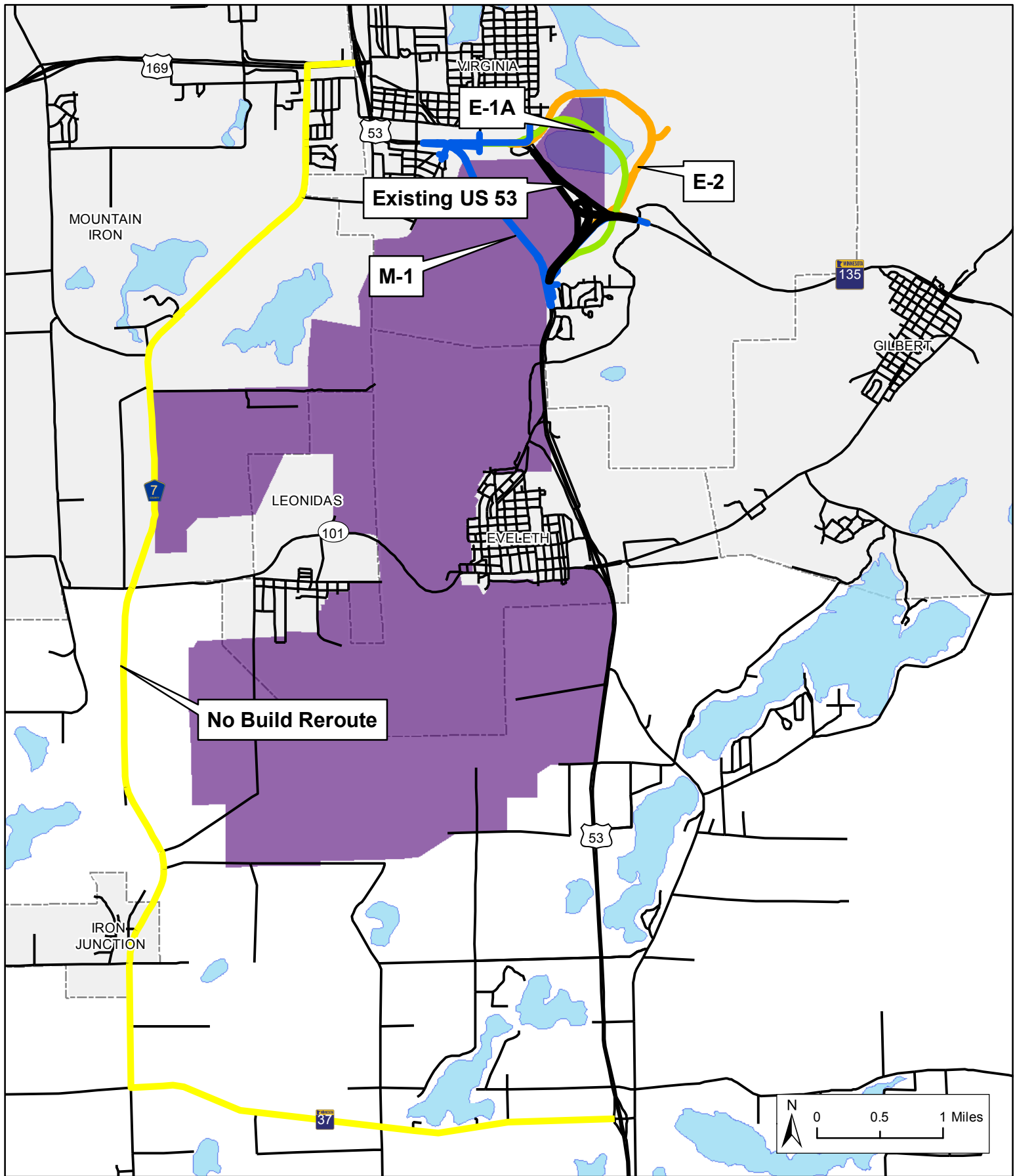


Legend

- Existing US 53 Alternative
- No Build Alternative
- No Build Reroute
- M-1 Alternative
- E-2 Alternative
- Biwabik Iron Formation
- Municipalities



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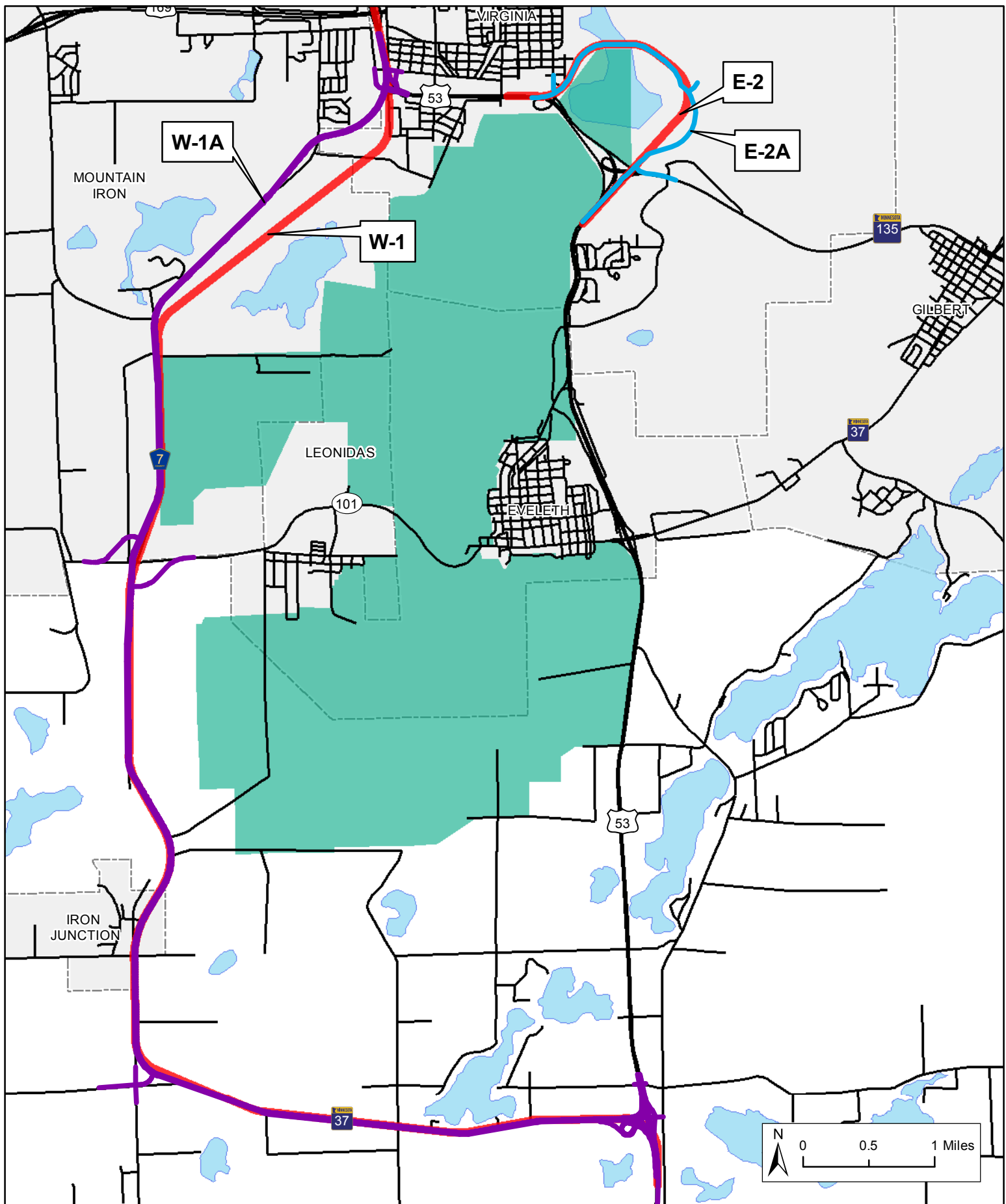


Legend

- Existing US 53 Alternative
- No Build Alternative
- M-1 Alternative
- E-1A Alternative
- E-2 Alternative
- UTAC Environmental Setting Boundary
- Municipalities



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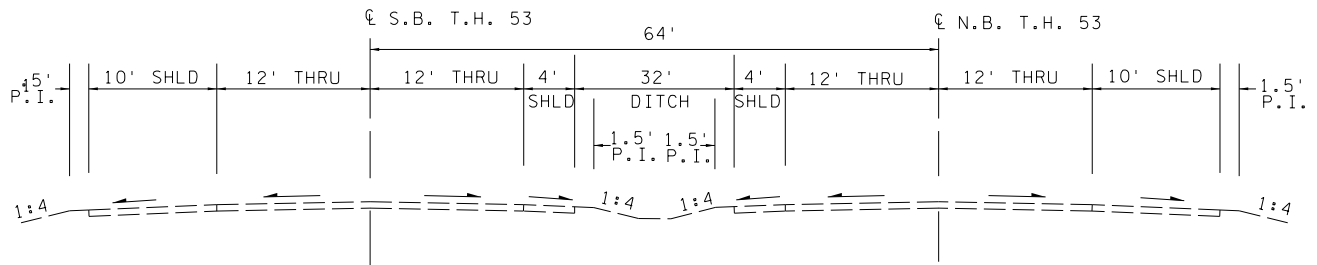
Legend

- Alternative E-2A (2013)
- Alternative W-1A (2013)
- Alignments from 2012 SDD
- UTAC Environmental Setting Boundary
- Municipalities

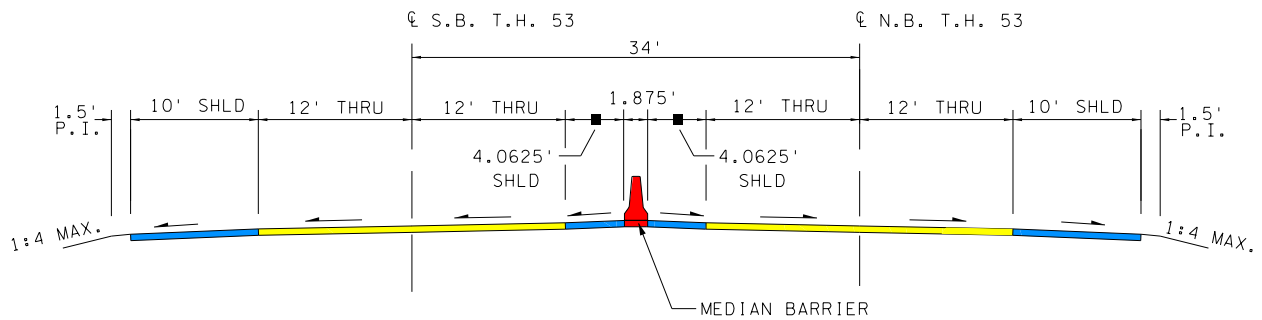
Exhibit 3.2
Alternatives E-2A and W-1A
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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INPLACE US 53 TYPICAL SECTION



US 53 - CONSTRAINED TYPICAL SECTION

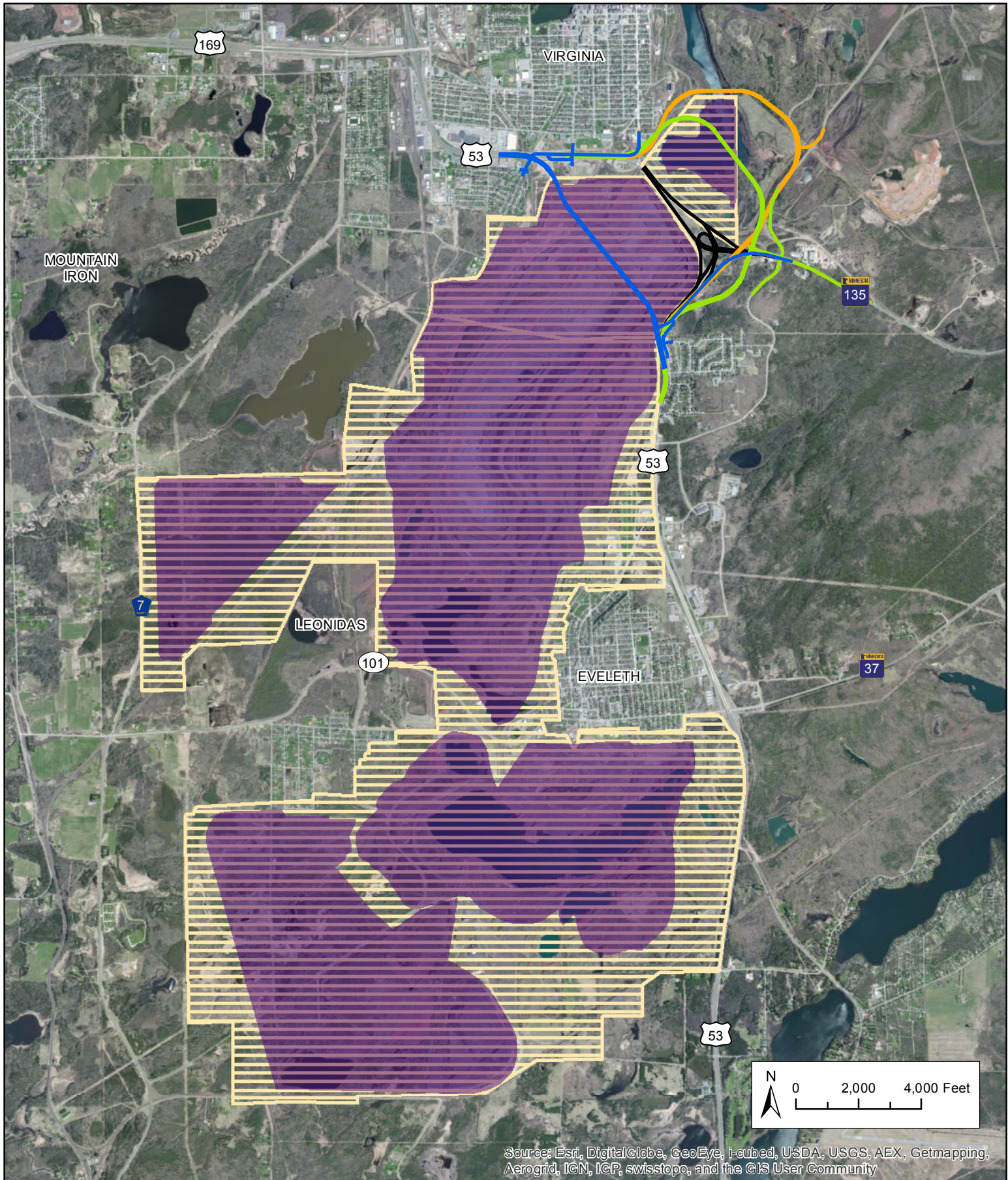


Source: SEH Layout 11/27/2012



Exhibit 3.3
Existing and Constrained Typical Sections
US Highway 53 Virginia to Eveleth
Alternatives Development Report

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Source: DNR

Legend







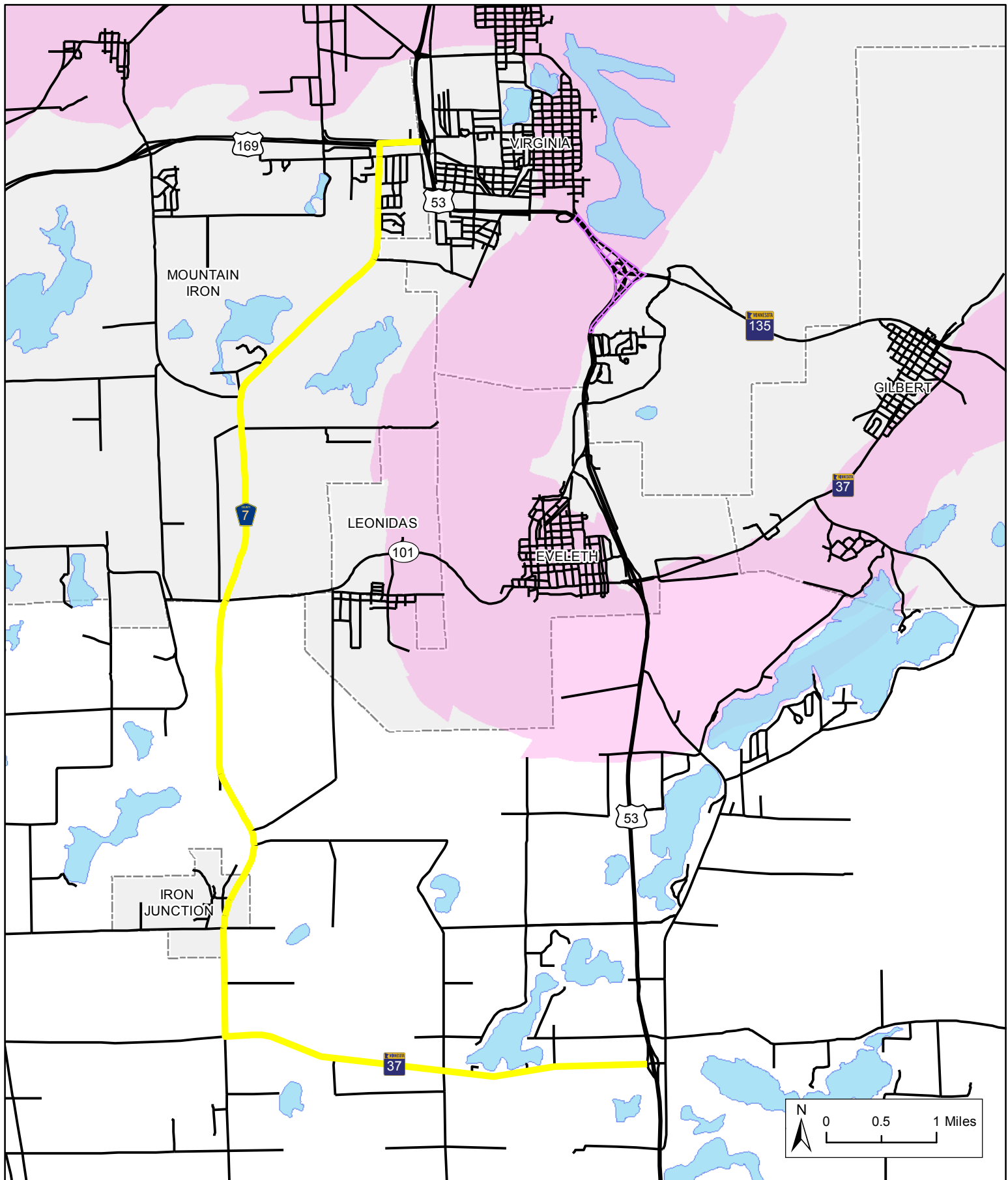
- | | |
|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  Existing US 53 Alternative |  UTAC Permit to Mine Boundary |
|  Alternative M-1 |  UTAC Environmental Setting Boundary |
|  Alternative E-1A | |
|  Alternative E-2 | |







Exhibit 3.4
Known Limits of Approved
Mine Operations
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Legend

-  Existing US 53 Easement Area
-  No Build Alternative
-  Biwabik Iron Formation
-  Municipalities



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Source: USGS Aerial 2011



Legend

- Existing US 53 Alternative
- Existing US 53 Easement Area
- - - Existing Mesabi Trail
- Existing School Trust Land

Exhibit 4.2
Existing US 53 Alternative
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Source: USGS Aerial 2011

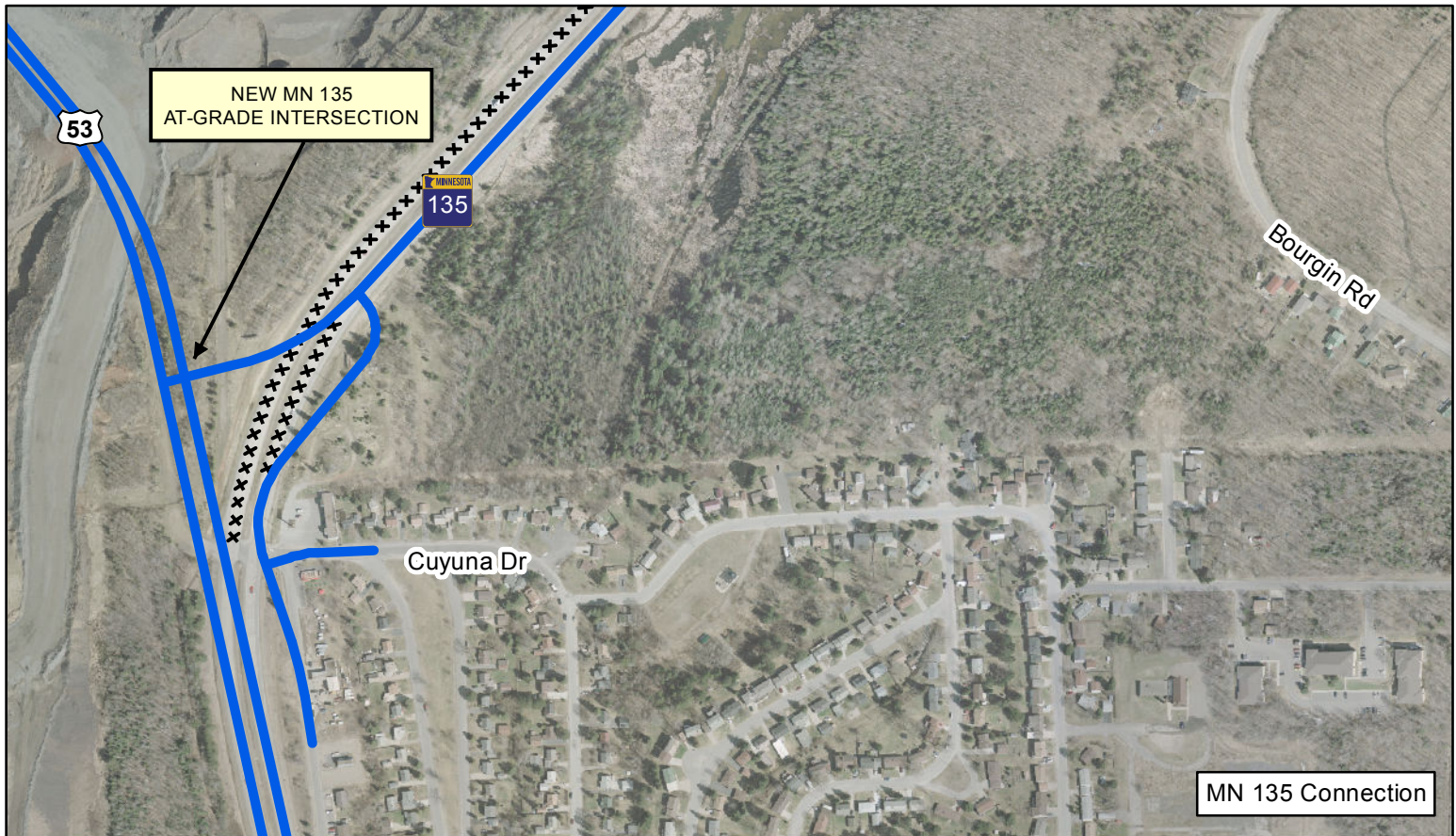
Legend

- Alternative M-1 Area of Evaluation
- Existing US 53 Easement Agreement Area
- Existing Public Recreation Land
- Existing School Trust Land
- Existing Mesabi Trail



Exhibit 4.3
Alternative M-1
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Source: MnDOT Aerial 2011



Legend

- Alternative M-1
- xxx Road Removed

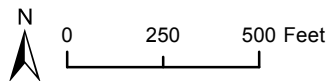
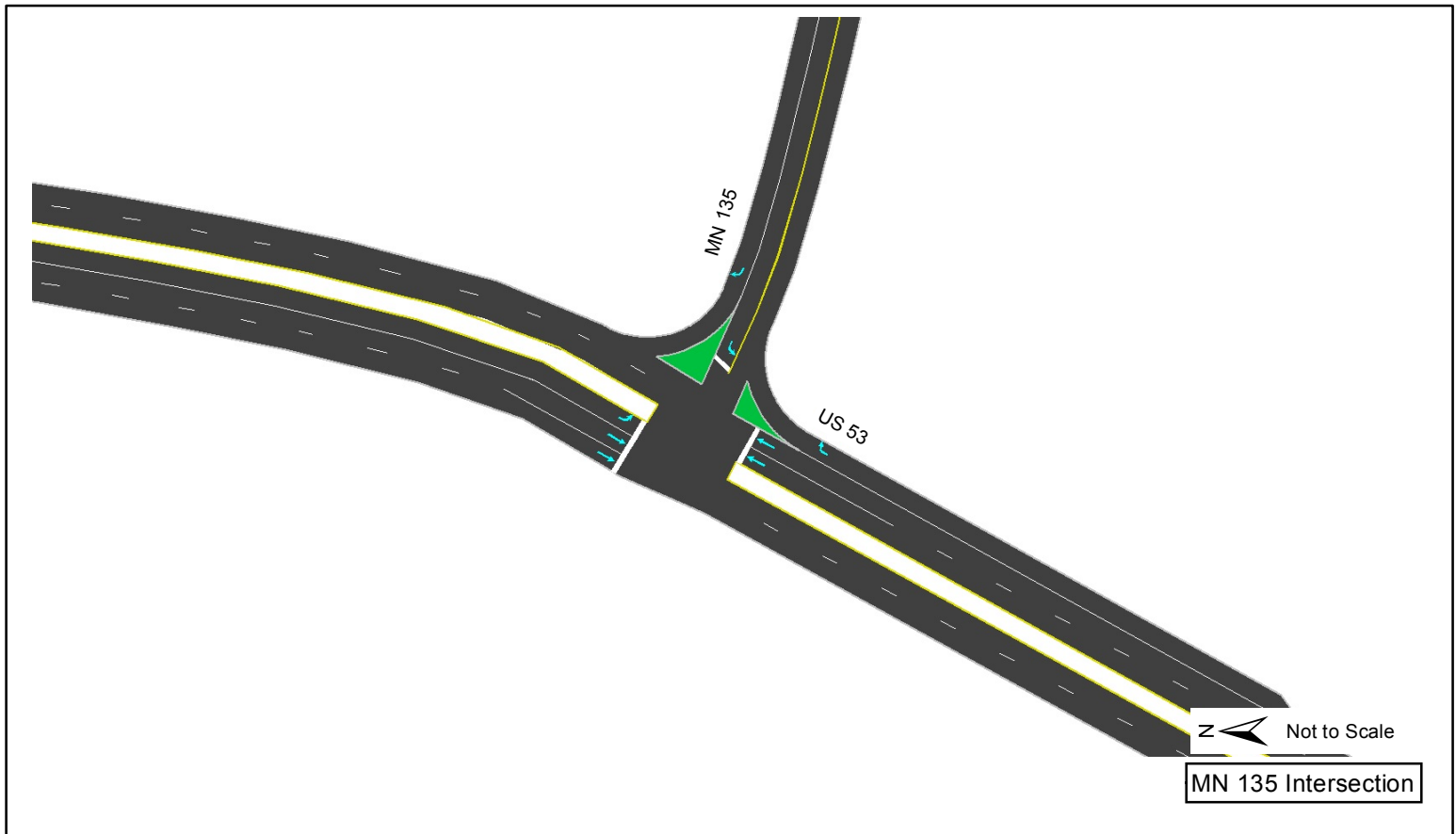
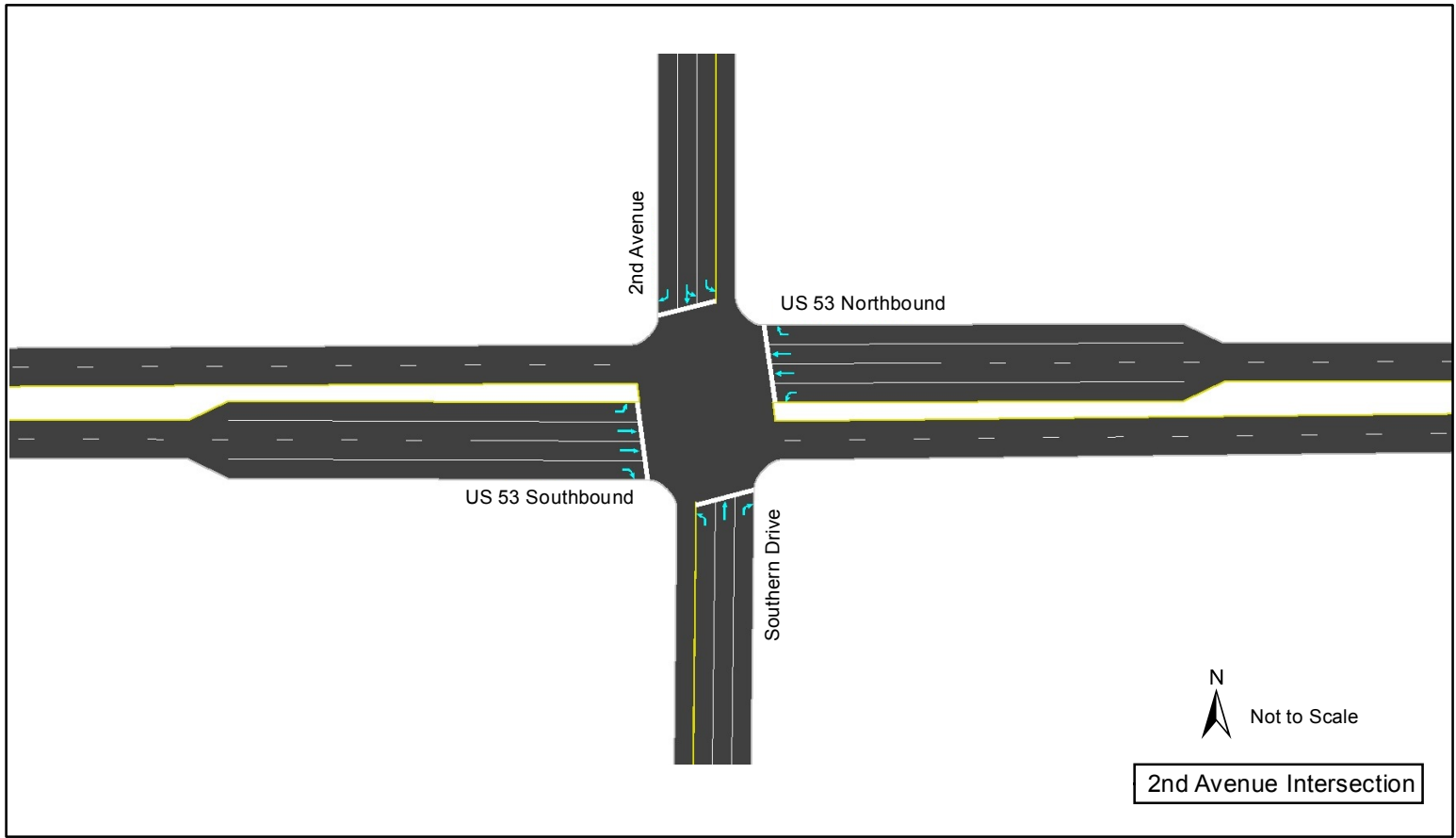


Exhibit 4.4
Alternative M-1
Local Street Connections
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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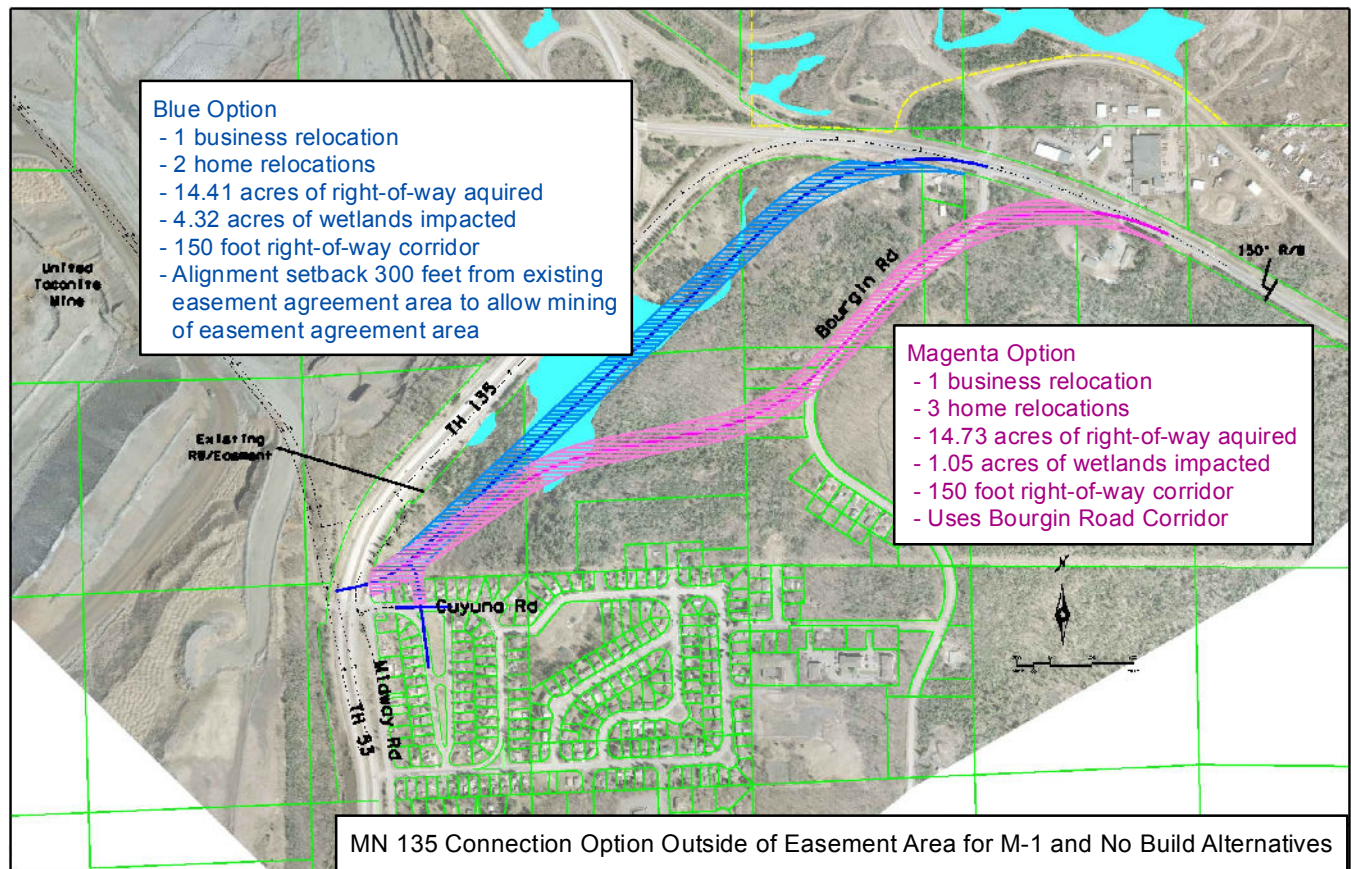
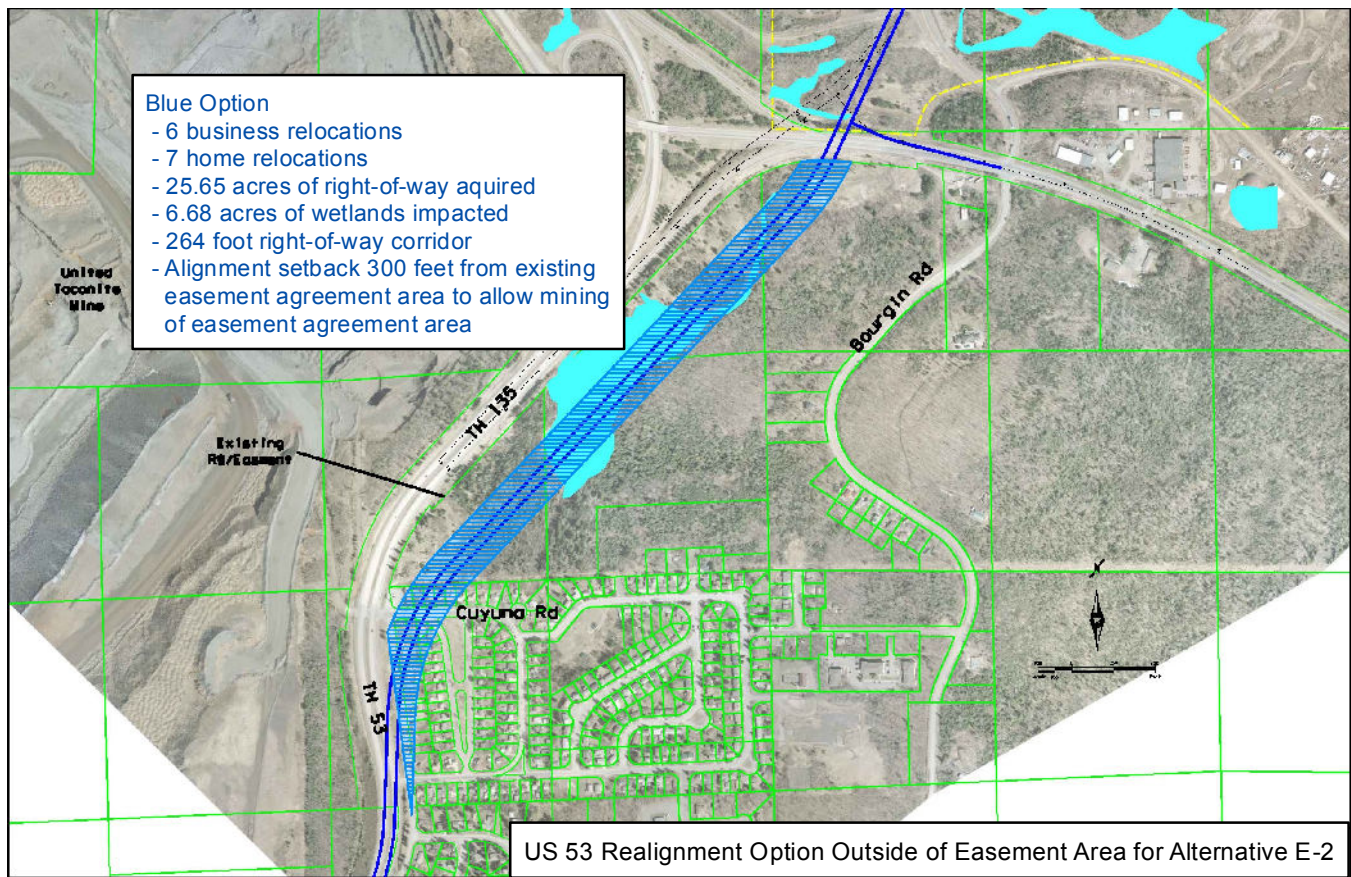


Source: Traffic Analysis Technical Report (2013)



Exhibit 4.5
Alternative M-1 Intersections
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

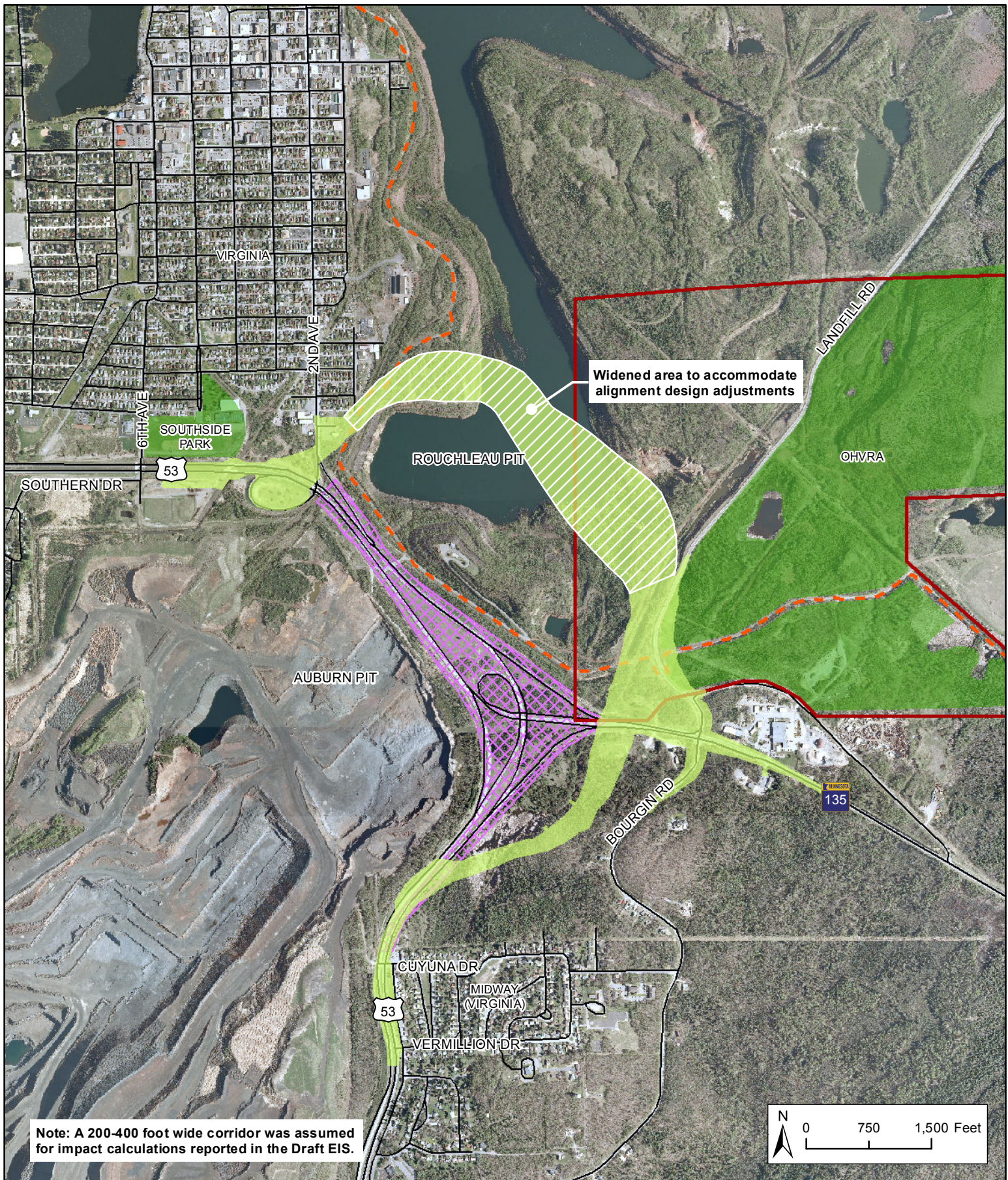
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Source: SEH Layout 11/8/12



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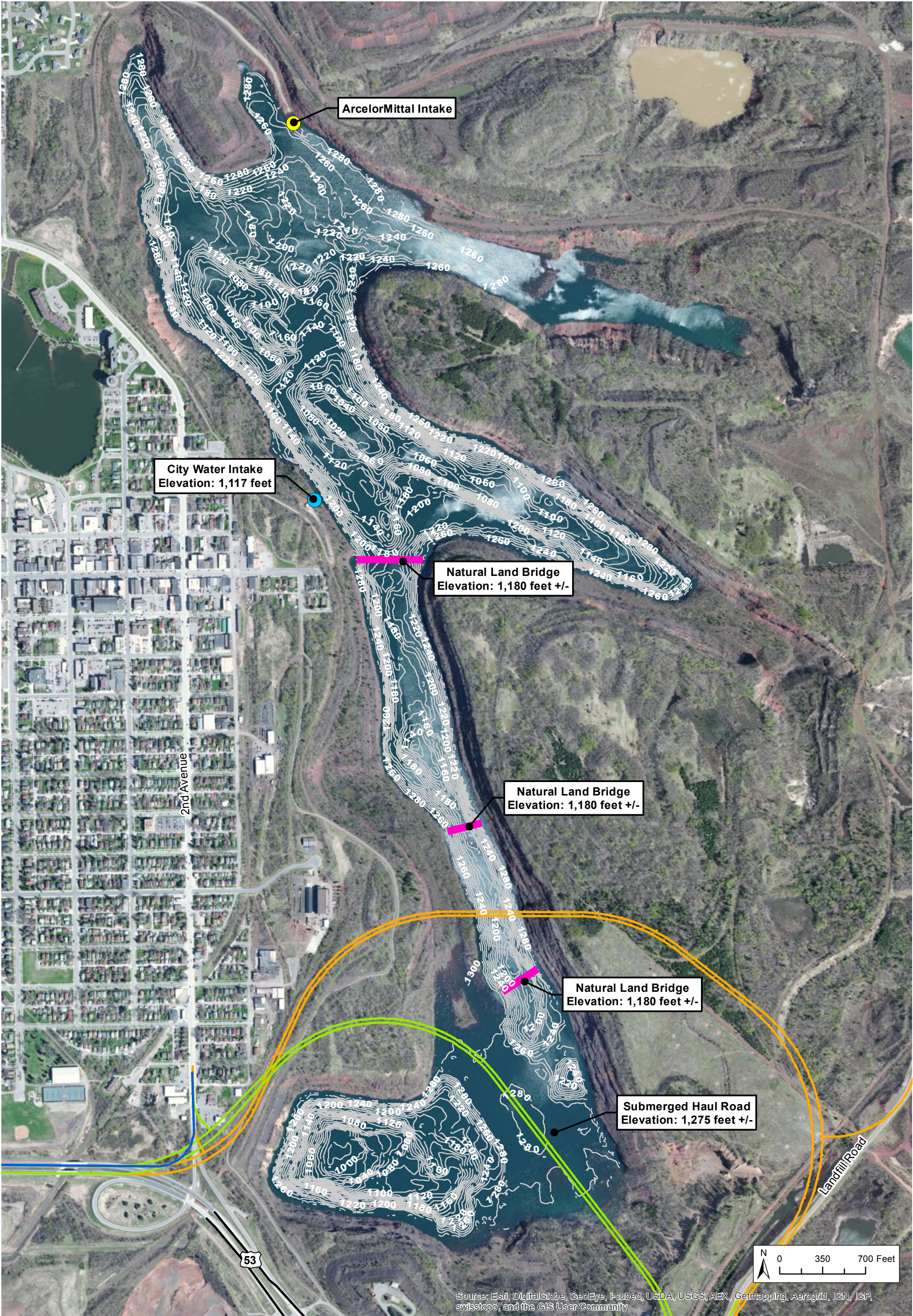


Legend


- Alternative E-1A Area of
- Existing US 53 Easement Agreement Area
- Existing School Trust Land
- Existing Mesabi Trail
- Existing Public Recreation Land

Exhibit 4.7
Alternative E-1A
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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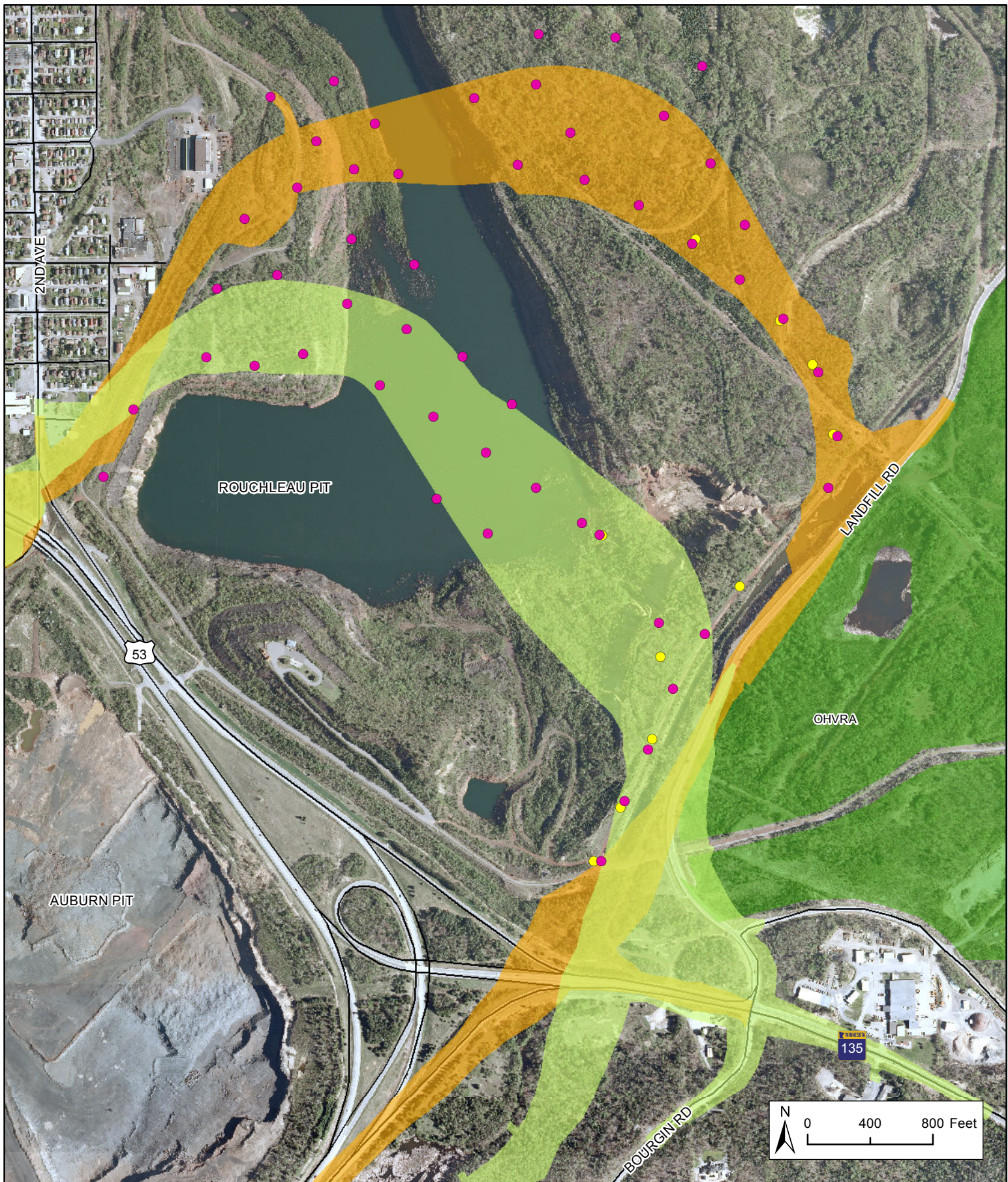
Source: MnDOT, 2013



Legend

- Natural Land Bridges
- Bathymetric Survey
- Existing US 53 Alternative
- Alternative M-1
- Alternative E-1A
- Alternative E-2

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Source: USGS Aerial 2011



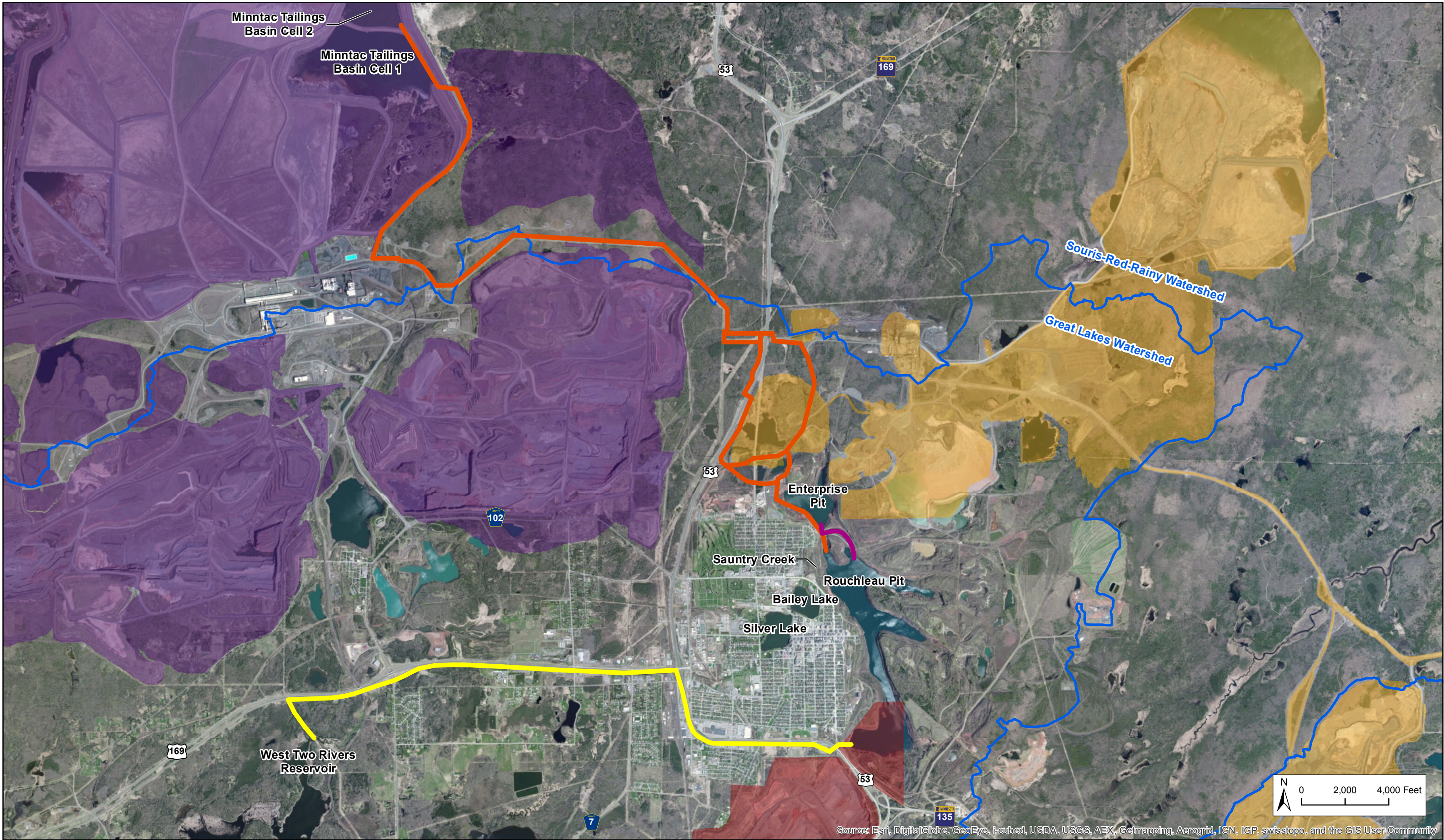
Legend

- Ferrous Exploratory Boring Locations
- Non-Ferrous Exploratory Boring Locations

- Alternative E-1A Area of Evaluation
- Alternative E-2 Area of Evaluation

Exhibit 4.9
Exploratory Borehole Sites
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Source: DNR Level 1 Watersheds; DNR Division of Lands & Minerals

Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



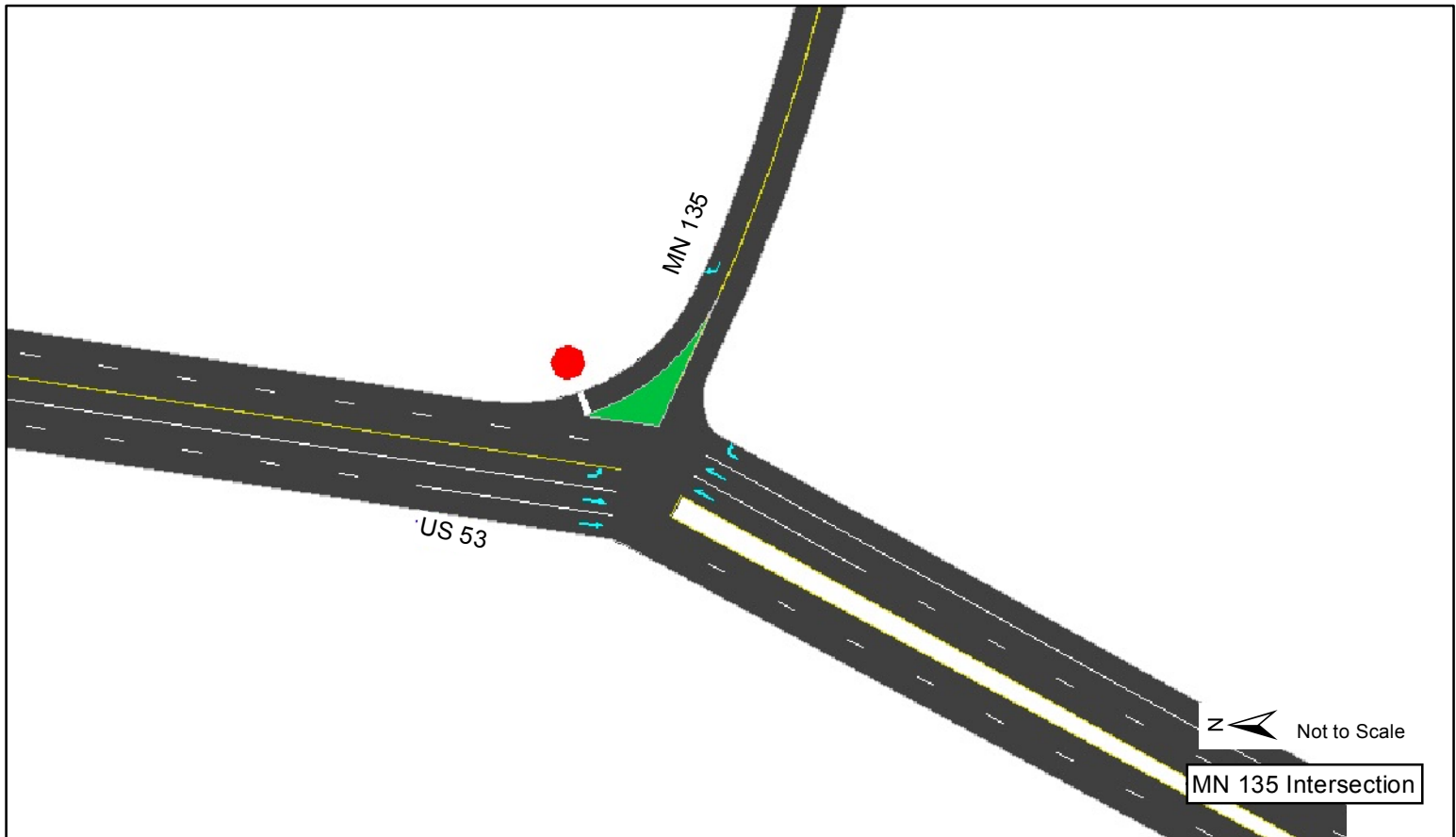
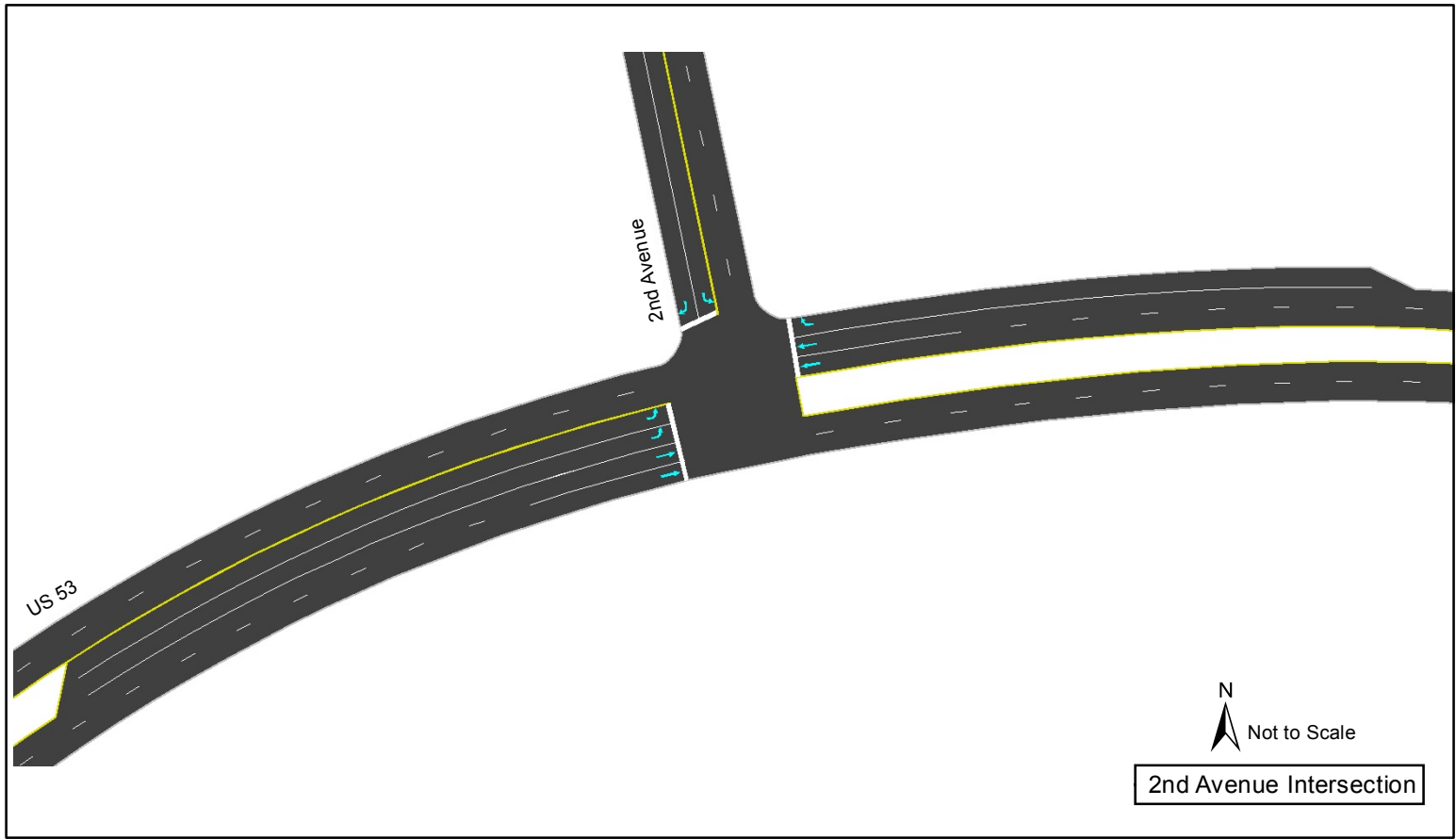
Legend

- West Two Rivers Reservoir Option
- Minntac Tailings Basin Cell 2 Option
- Enterprise Pit Option
- Minntac Permit to Mine Boundary
- UTAC Environmental Setting Boundary
- ArcelorMittal Ultimate Permit to Mine Boundary

Laurentian Divide

Exhibit 4.10
Dewatering Route Options
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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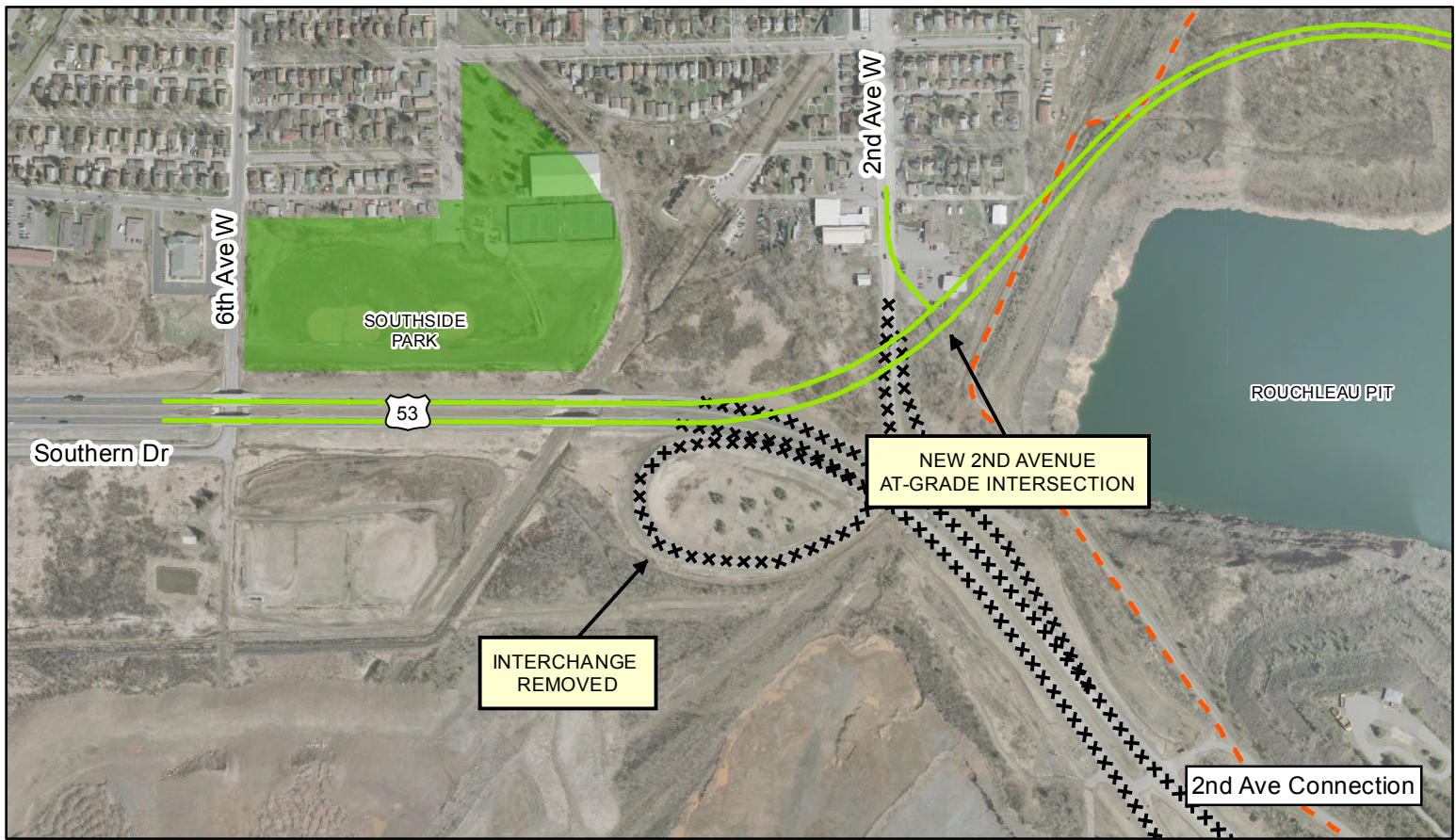


Source: Traffic Analysis Technical Report (2013)



Exhibit 4.11
Alternative E-1A and E-2 Intersections
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Source: MnDOT Aerial 2011



Legend

- Alternative E-1A
- - - Existing Mesabi Trail
- xxx Road Removals



0 250 500 Feet

Exhibit 4.12
Alternative E-1A
Local Street Connections
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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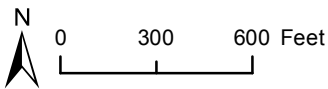
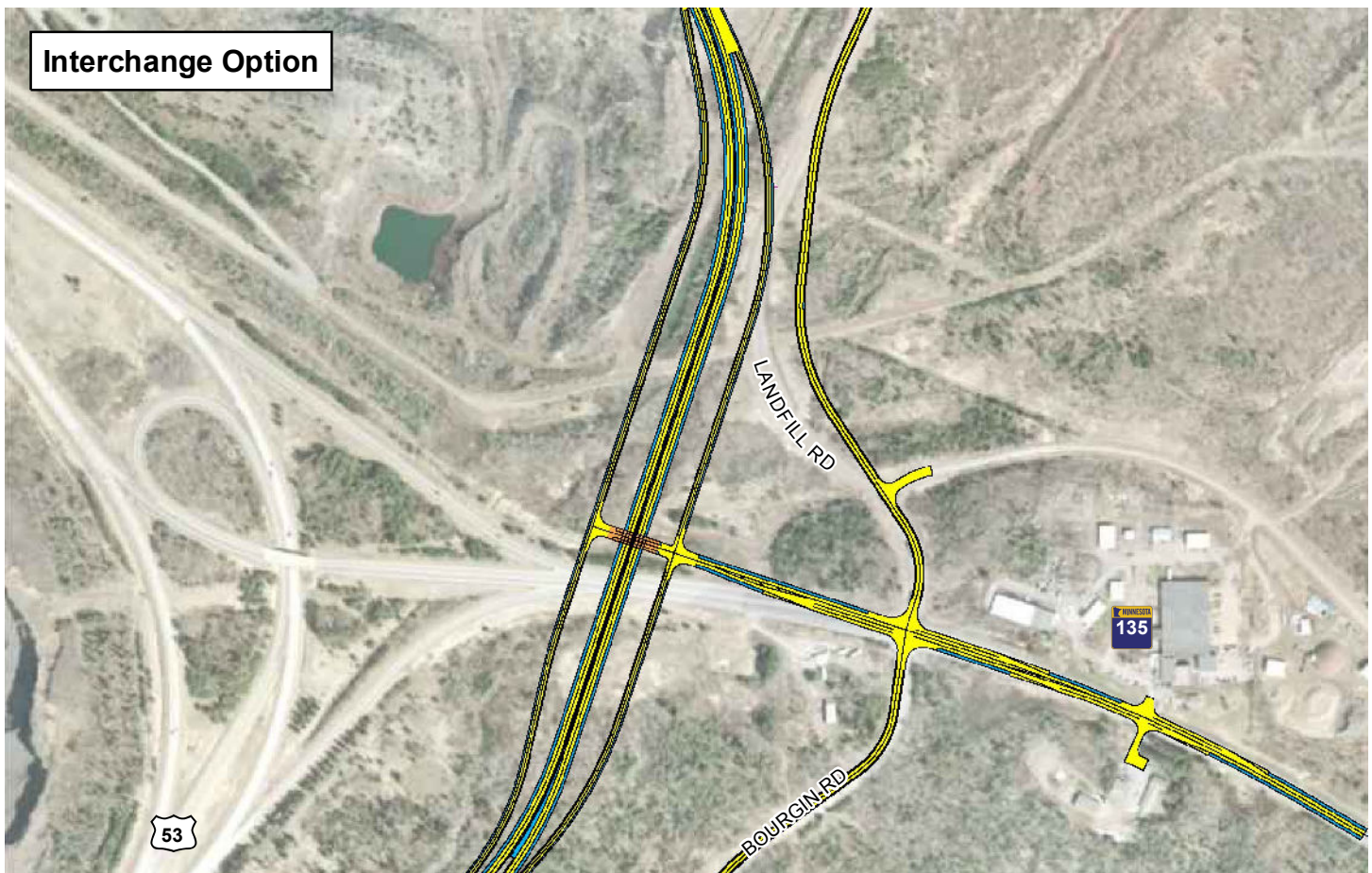
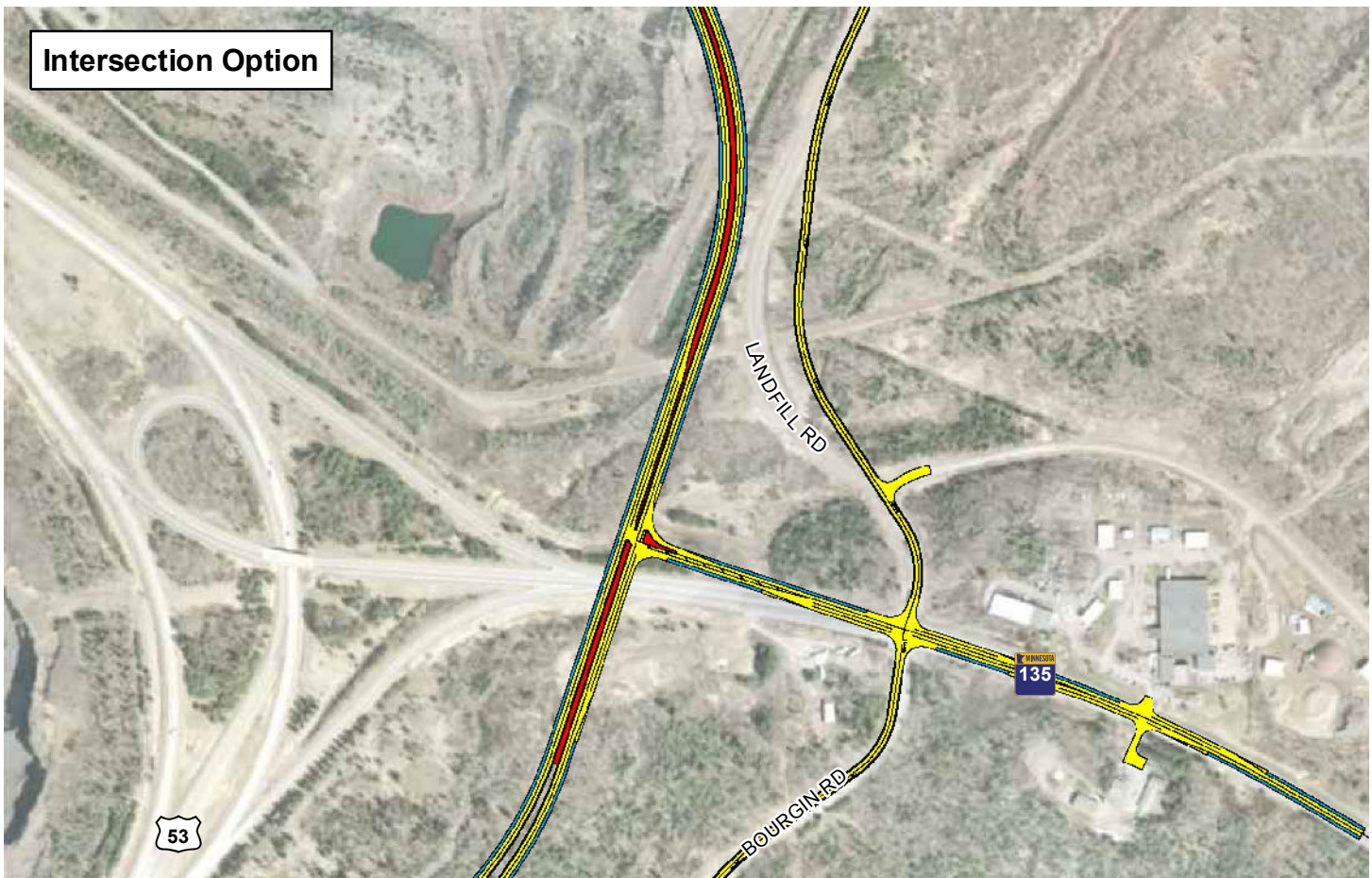
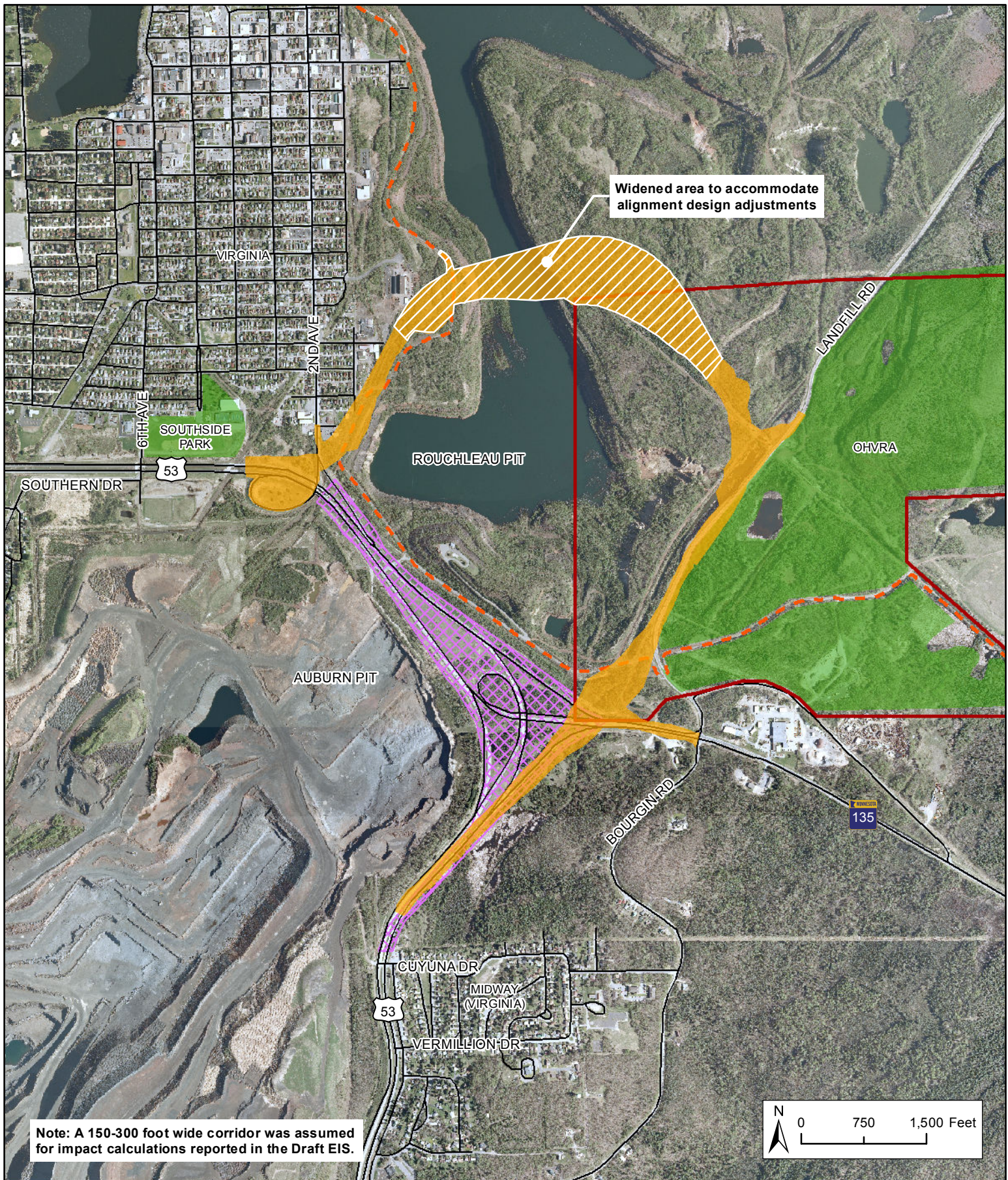


Exhibit 4.13
Alternative E-1A Intersection and Interchange Options
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Source: USGS Aerial 2011

Legend



- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alternative E-2 Area of Evaluation | Existing Mesabi Trail |
| Existing US 53 Easement Agreement Area | Existing Public Recreation Land |
| Existing School Trust Land | |

Exhibit 4.14
Alternative E-2
US Highway 53 Virginia to Eveleth
Alternatives Development Report

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Source: MnDOT Aerial 2011



Legend

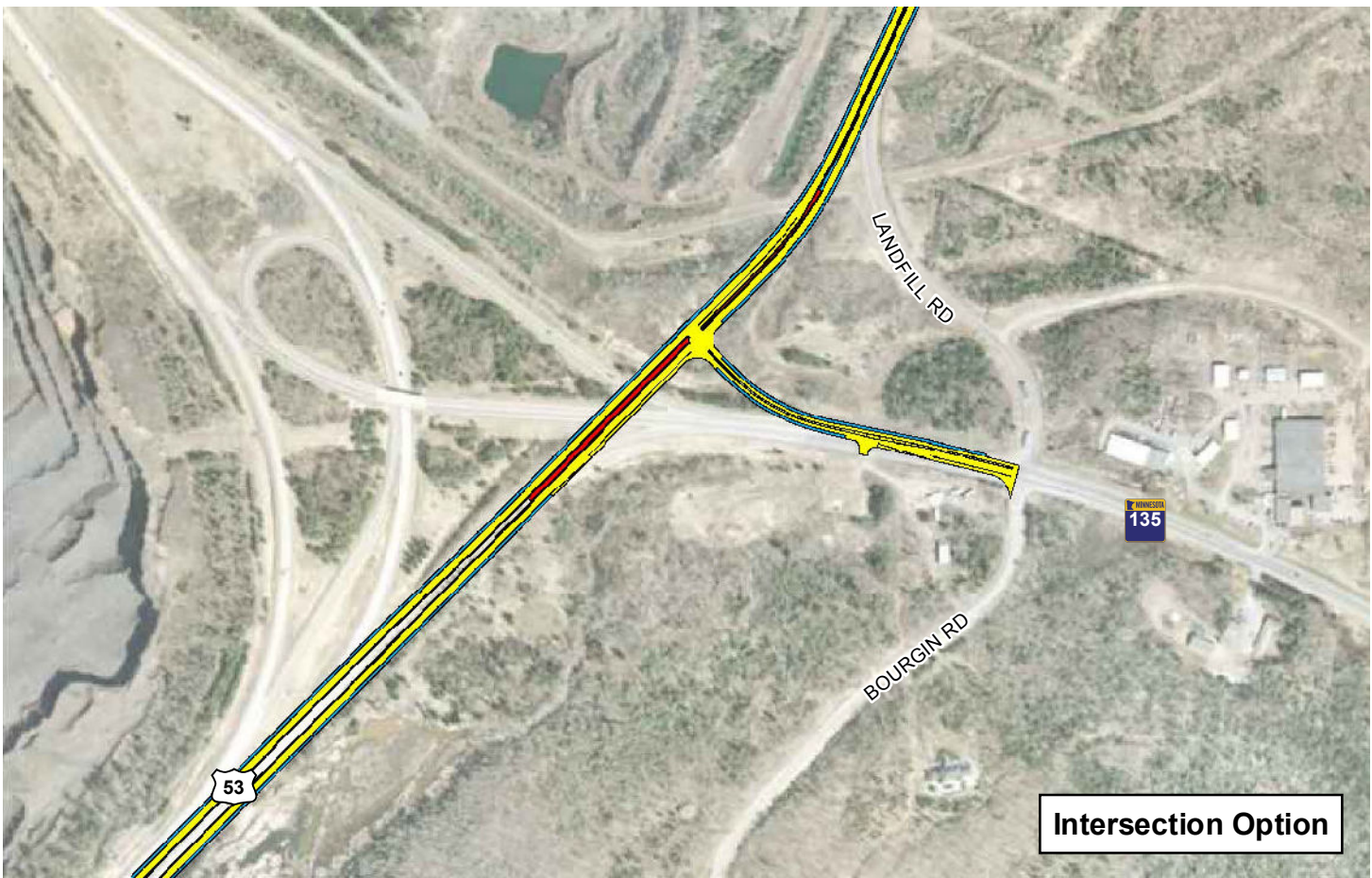
- Alternative E-2
- xxx Road Removals
- Existing Mesabi Trail



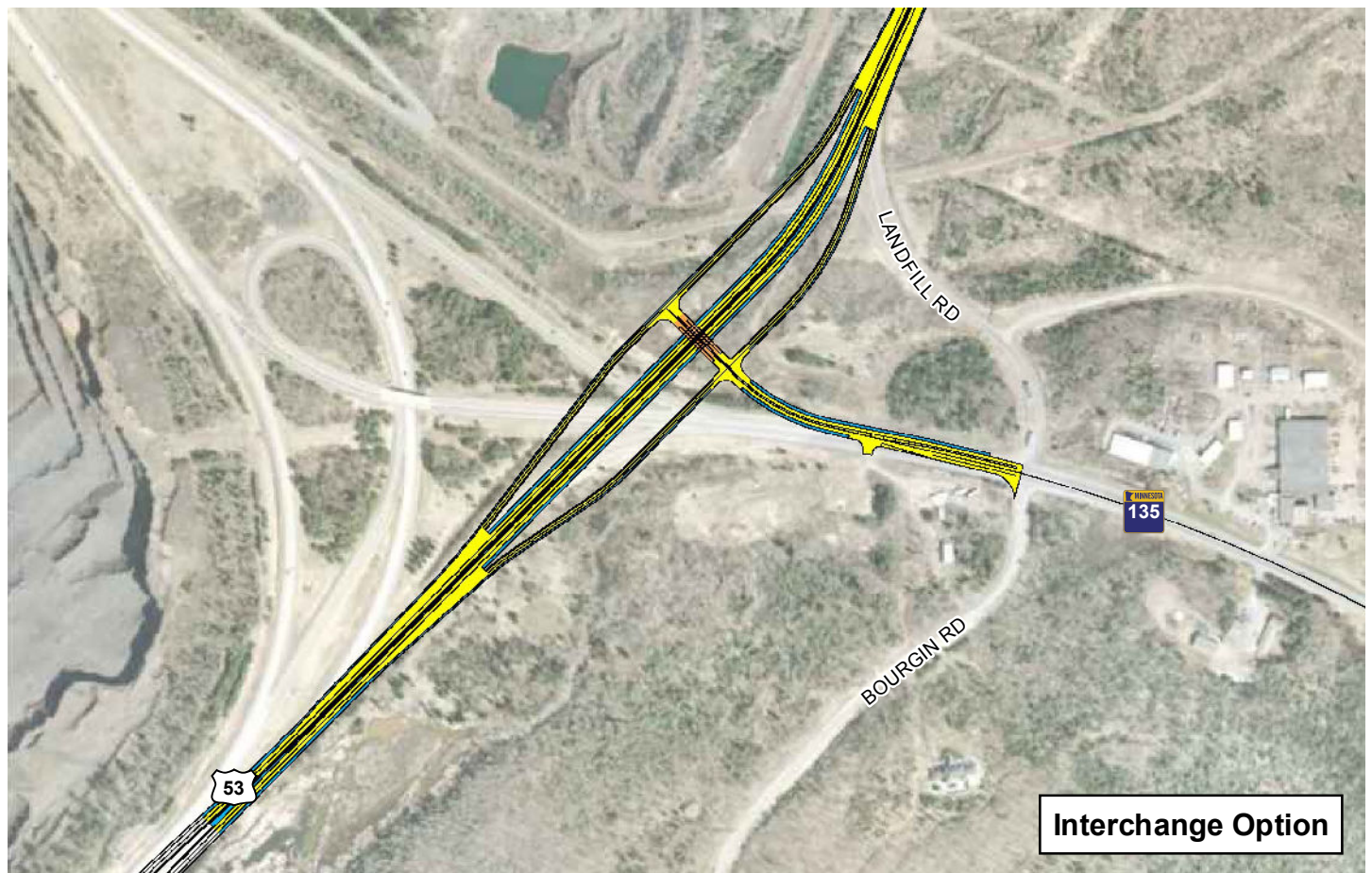
0 250 500 Feet

Exhibit 4.15
Alternative E-2
Local Street Connections
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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Intersection Option



Interchange Option

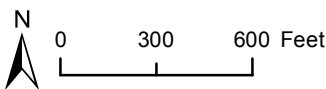


Exhibit 4.16
Alternative E-2 Intersection and Interchange Options
 US Highway 53 Virginia to Eveleth
 Alternatives Development Report

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